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FOREIGN MILITARY REVIEW

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Following the Course of Acceleration and Perestroyka

18010461a Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 3-6

[Lead Article]

[Text] The 27th CPSU Congress charted the strategic course for socialism's successive and comprehensive improvement, and for further advance of Soviet society toward communism on the basis of accelerated socioeconomic development. It is directed at putting the most up-to-date face on socialism, one corresponding to the conditions and needs of the scientific and technical revolution and to intellectual progress. This is a relatively lengthy process of perestroyka and revolutionary renewal.

The goal of perestroyka is to fully rehabilitate Lenin's conception of socialism both theoretically and practically, and to reveal the enormous social resources of our social and state structure to the fullest by activating the human factor. Socialism is being given a new quality or, in other words, a second wind with which to realize its truly inexhaustible possibilities.

The uniqueness and power of the changes occurring in our country today lie in the fact that firm political will, decisiveness and courage are important and necessary for such change, as is sensitive reaction to processes occurring among the people. These changes, in V. I. Lenin's words, require the ability to proceed "at the level of consciousness and resolve of the majority of the popular masses, at the level of their own experience" ("Poln. sobr. soch." [Complete Collected Works], Vol 34, p 207). The skill of CPSU policy lies precisely in the ability to combine these aspects of dialectical conflict.

Perestroyka has entered our life as a matter of the entire party, of all the people, as a pressing and immediate problem, one that has emerged out of the profound processes of our socialist society's development. Vladimir Ilich said at one time that Russia achieved Marxism through much suffering. We can now say that the country has truly achieved perestroyka with much suffering. It marks a transition from extensive to intensive development. This extremely necessary form of developing socialism is called upon to ensure its accelerated progress.

"Perestroyka," notes M. S. Gorbachev in the book "Perestroyka i novoye politicheskoye myshleniye dlya nashey strany i dlya vsego mira" [Perestroyka and New Political Thinking for Our Country and for All the World], "is a revolutionary process, since it represents a leap in the development of socialism, in the realization of its essential characteristics. We recognized from the very beginning that there is no time for a warm-up. It is very important to not fall asleep in the starting gate, to catch up." Implementing perestroyka, the party is striving to create, first of all, a dependable and flexible mechanism by which to really encourage all laborers to participate in solving state and public problems. Second it is striving to practically teach the people to live and work under the conditions of deepening democracy, and to expand and strengthen human rights.

The present five-year plan is the hardest ever. It is unique in that the old economic mechanism is still functioning, while at the same time a new one is being incorporated. Fundamental measures directed at attaining real end results are already being implemented everywhere. Inseparably associated with them are the major political and socioeconomic shifts occurring in our society, and the confirmation of the new way of life.

The first initial stage of perestroyka has basically been completed. The CPSU developed its conception and made the most important decisions. Without these decisions, it would have been impossible to act with the future in mind while simultaneously dealing with current problems.

Many of our society's forces were put into motion in the first stage. Theoretical and political research was completed through joint effort. The most complex stage, in which the perestroyka conception must come into the widest communion with the life and practical activities of million of Soviet people, has now begun.

The biggest things are yet to come. But the Soviet people have already sensed and perceived that a new moral atmosphere has been created in our country, and that it continues to improve. The activity of the people is experiencing a rebirth, mistakes made in the period of stagnation and conservatism are being corrected, and the processes of democratization and glasnost are under way. All of this has decisive significance to the country's destiny.

Significant shifts are occurring in the economy. Major programs to develop machine building and computer technology and to increase consumer goods production have been written and are now being implemented. The practice of state acceptance has expanded, having a favorable effect on article quality. Adoption of the Law on the State Enterprise (Association) was an important event. The new methods of controlling the economy and the new economic mechanism are creating real conditions for growth of the effectiveness of social production.

A mass transition of the national economy's sectors to full cost accounting and self-financing has begun. The basic directions of restructuring all echelons of planning and control have been defined. A new viewpoint on public property, on cooperative forms of labor, on individual labor and on sensible combination of plans and

the market has formed as well. Having generalized the accumulated experience, the June (1987) CPSU Central Committee Plenum developed an integrated system of economic control called upon to become a powerful lever by which to accelerate the country's socioeconomic development.

The goal of radical economic reform is to ensure, in the next 2 or 3 years, a transition from an excessively centralized control system based on administrative direction from above, to a democratic system based predominantly on economic methods and on an optimum combination of centralism and self-control. It presupposes dramatic expansion of the independence of associations and enterprises, their transition to full cost accounting and self-financing, and provision of all rights necessary for this to the labor collectives.

All of this is already affecting economic practices. Interest in the financial and economic results of work is noticeably increasing in the collectives. A real effort is beginning to be made in calculating outlays and summarizing results, in economizing in things large and small, and in finding the most effective solutions to problems. On the whole, the economic reform and perestroyka are actively raising the individual to a position of prominence. Social justice requires that we also intensify attention to manifestation of individual capabilities and to moral and material encouragement of those who work more and better, and who serve as examples to others.

A significant amount of economic organizational work has been done. An important step has been taken: Hundreds of obsolete standards were reexamined and repealed—various departmental instructions which have worked like a net to restrain initiative in management. The system of sanctions and fines was subjected to significant changes. Transformations are going on simultaneously in all echelons of control—in central economic departments, in ministries and in territorial organs.

In the last 3 years the rate of growth of labor productivity exceeded the mean annual indicators of the 11th Five-Year Plan by a factor of 1.3 in industry, 1.6 in construction, 2.8 in agriculture and 3.6 in rail transportation. While in 1981-1984 growth of the productivity of social labor was responsible for 86 percent of the increment in national income, and for 95 percent in 1985-1986, in 1987 it was responsible for 100 percent of the increment. This was achieved in industry even with a manpower reduction.

It is also very important that the situation has changed for the better in terms of the rate of growth of wages and the productivity of social labor. Growth of wages is now indexed to growth of labor productivity. The economic mechanism is beginning to function at full power.

The party views social policy as a mighty resource for accelerating the country's development, increasing the sociopolitical activity of the masses and encouraging them to work harder, forming the new man and confirming the socialist way of life, as an important factor of the society's political stability. The CPSU feels that unweakening concern for solving the social problems of labor, life and culture and for satisfying the interests and needs of the people must become the law of the activity of all state and economic organs and social organizations.

Much has been done to reinforce the social orientation of the entire national economy. By as early as 1987 the rate of growth of capital investments for this purpose (into creation of the material base of the social sphere) was three times higher than in the national economy as a whole. On an annual average, in the last 3 years (1985-1987) there was a 9 percent increase in housing, a 28 percent increase in secondary schools, a 4 percent increase in vocational-technical schools, a 10 percent increase in preschool institutions, a 9 percent increase in hospitals, a 24 percent increase in polyclinics and a 46 percent increase in clubs. The housing conditions of 32 million persons were improved during this period.

Acceleration and perestroyka have made further deepening and development of socialist democracy the most important task. Democratization of society is the strongest guarantee of transformations in policy and economics. This is precisely why further democratization of Soviet society, including of the election system, legal reform and reform of the courts, and improvement of the country's control organs will be the main and central problems addressed in the forthcoming 19th All-Union CPSU Conference. There is a need to thoroughly evaluate the real changes that have occurred in the economic, social and spiritual spheres, to reveal shortcomings and mistakes, to find ways to increase work results, to accelerate perestroyka, to surmount inertia and routine and to allow wide room for the initiative of communists.

Perestroyka and development of democracy are making it possible to make fuller use of the energy, possibilities and rights of trade unions, the Komsomol and other social organizations, including ones that came into being in recent years—for example the All-Union Council of War and Labor Veterans, women's councils, the Soviet Cultural Fund and the Children's Fund imeni V. I. Lenin. Their day-to-day activities are oriented on solving vitally important problems, and they reflect the interests of the broad masses of laborers.

The revolutionary transformations occurring in the country are also redefining the issues of general, political and legal culture. Flaws such as bureaucracy, mismanagement and irresponsibility are associated in many ways precisely with shortcomings of such culture. The real culture of socialist democracy can accept neither the directive "pressure" style, nor organizational diffusion, nor substitution of action by hot air. All of these things are alien to socialism. Nor is there any doubt in this: The

wider and deeper democracy becomes, the more attention socialist legality, law and order demand and the more necessary organization and conscious discipline become to people.

The orientation of perestroyka in the armed forces, its principal reference point, is raising the combat readiness of the troops and naval forces in the interests of the might of our socialist fatherland. A sincere interest in this on the part of every communist is an indispensable prerequisite of movement toward the goal. And in order that this movement would be dynamic, and in order that it would gather momentum, it is especially important for communist leaders to set the example. Commanders, political organs and party organizations are persistently working to see that Lenin's style confirms itself in the work of military personnel, that the requirements of military regulations are implemented strictly and unfailingly, and that they are followed in spirit and to the letter.

The new stage of perestroyka has required every party organization to activate its political, organizational and ideological efforts, and to be able to develop the initiative of the people and to direct their efforts at the main tasks.

Perestroyka also means democratization of all aspects of the life of army and navy collectives, confirmation of bolshevik comradeship in party organizations, development of glasnost, criticism and self- criticism, introduction of the elements of creativity into the work of Komsomol organizations, and activation of all of our social institutions; it means making the strictest possible compliance with military regulations, legality and social justice the main line of attack.

Is democratization an acceptable phenomenon in the armed forces, where all of the life and activities of servicemen are strictly regulated? Answering this question, USSR Minister of Defense Army General D. T. Yazov emphasized: "Democratization is not only acceptable in our armed forces, but it is also a necessary prerequisite of their normal function, of successful fulfillment of the missions of defending the socialist fatherland. It does not contradict the provisions of regulations, orders and directives serving as guidelines for the armed forces, and it expresses the socialist nature of our army—an army of a new type." Soviet laws and military regulations are permeated by a spirit of democracy. Before their requirements, all are equal—chiefs and subordinates, all servicemen. Nor is democracy in conflict with one-man command, which functions to promote unity of will and actions in the Soviet Army and Navy.

The new, decisive stage of perestroyka has necessitated a higher level of activity on the part of all party organizations. Valuable experience in intensifying party influence on combat training, tightening military discipline, improving ideological work, developing party democracy and confirming a responsible attitude of the personnel toward military service has been accumulated in this direction.

CPSU members are exhibiting an increase in initiative, adherence to principles and mutual exactingness. The role of party meetings is rising noticeably in this regard. Thoughtful preparation for them and creation of an atmosphere of exactingness and comradely criticism and self-criticism help to raise their effectiveness and intensify the influence of communists on all aspects of the life and activities of military collectives.

Komsomol and trade union organizations and other social institutions of the army and navy are working more actively. Perestroyka foresees, for example, a greater role for personnel meetings. The effectiveness of officer conferences—a good democratic form of joint discussion of pressing problems and decisions—is rising.

Acceleration of socioeconomic development and perestroyka have enormous international significance. Perestroyka is based on a new way of political thinking not only in our country but also in the entire world. It is a means of eliminating the threat of war and solving some fundamental problems of mankind in general.

A thorough Marxist-Leninist analysis of the problems of world development and further development of the conception of the new way of political thinking can be found in M. S. Gorbachev's report "October and Perestroyka: The Revolution Continues" given at a solemn meeting of the CPSU Central Committee, the USSR Supreme Soviet and the RSFSR Supreme Soviet dedicated to the 70th anniversary of the Great October Socialist Revolution. This report persuasively shows the way the CPSU sees the modern world and the sort of conclusions it reaches in regard to its practical activities, and what the Soviet people expect from the world community.

The conclusion is undeniable: Perestroyka is something a world saturated with nuclear weapons needs. The Soviet Union confirms and thoroughly substantiates the possibility of perestroyka; moreover it offers well-grounded proof that if we are really concerned about tomorrow's civilization, there is no other way. The 27th CPSU Congress introduced the conception of today's interrelated, interdependent, contradictory and, at the same time, essentially integral world.

The problems of international and national security and social development are closely interdependent in the modern era. Lenin's conception of peaceful coexistence of different social systems is acquiring new, more-multifaceted content. The new facets of its content reflect

unique features of the nuclear era and the integrity of the world, despite its diversity, contradictions and acute global problems.How to ensure the survival of mankind, to lead it out of the dead end of the nuclear arms race without infringing upon the way of life and values of sovereign nations—this is the main problem today. The key to its solution can be found in the 15 January 1986 declaration of the CPSU Central Committee general secretary. It has become a manifesto of the approaching era of nuclear disarmament. The concrete and detailed program of stage-by-stage elimination of all nuclear arms and other resources of mass annihilation before the end of this century—a program promoted by the Soviet Union—demonstrated the unlimited possibilities of the new way of political thinking in regard to solving the most complex problems of mankind.

The Soviet-American treaty to eliminate intermediate and lesser range missiles is an important accomplishment on the road to removing the nuclear threat. This was an enormous political victory of the Leninist party, one of the successes of the new way of political thinking.

As with all Soviet people, soldiers of the Soviet Army and Navy avidly support the CPSU's course toward perestroyka, and they are striving to see that it continues to move forward unceasingly. Personnel of the units and subunits are looking hard for reserves and possibilities for further growth of alertness and combat readiness, and for reinforcement of military discipline. The selfless day-to-day military labor of the defenders of the motherland is a dependable guarantee that the party's grand plans for accelerating our country's socioeconomic development will be implemented.

The System for Programmed Development of U.S. Armament

18010461b Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 7-14

[Article by Col V. Karpov, Cand Tech Sci, and Lt Col Yu. Anyutin]

[Text] Certain circles of the USA began following the course of attaining military-technical superiority over the USSR immediately after World War II. A council forresearch conducted in the interests of ensuring so-called national security was formed under the U.S. Academy of Sciences in 1945. The council's task was to introduce the accomplishments of American researchers and scientists into the military. An organizational structure was soon formed to guide military scientific research and experimental design work. Scientific research directorates appeared in the armed forces departments. An interim presidential committee for science, the staff of the research and design director of the Defense Department and a long-range military research administration were created in 1958. The entire state system of science management in the USA underwent major reorganization in the 1970s: A law on the organizational principles and priorities of American scientific and technical policy was adopted, the research and design management organs of the Defense Department and the armed forces departments were restructured, and the procedures for planning and financing research and development were improved. The goal of these measures was to completely subordinate development of armament to the specific strategic, operational and tactical missions troops might have to carry out in modern warfare.

The organization of military research and design management has undergone practically continuous improvement in the USA. Thus the mechanism for shaping and

Key:
1. Defense undersecretary for procurement
2. Scientific committee
3. Organization for implementation of SDI
4. Assistants to the secretary of defense
5. For research and technology
6. For control and communications
7. For atomic energy
8. For materiel support
9. Directorates
10. Long-range research (DARPA)
11. Scientific and technical
12. Combat control and communication systems
13. National communication systems
14. Cartographic
15. Testing and evaluation
16. Nuclear ammunition
17. Communications
18. Undersecretary of the army—program chief administrator
19. Undersecretary of the air force—program chief administrator
20. Undersecretary of the navy—program chief administrator
21. Assistant secretary of the navy for research, design and procurement
22. Assistant secretary of the air force for research, design and procurement
23. Assistant secretary of the army for research, design and procurement
24. Program administrators
25. Weapon system development command
26. Program command
27. Program directors
28. Scientific research laboratories, arsenals, proving grounds, scientific engineering centers, industrial scientific research institutions, universities, federal contracting centers

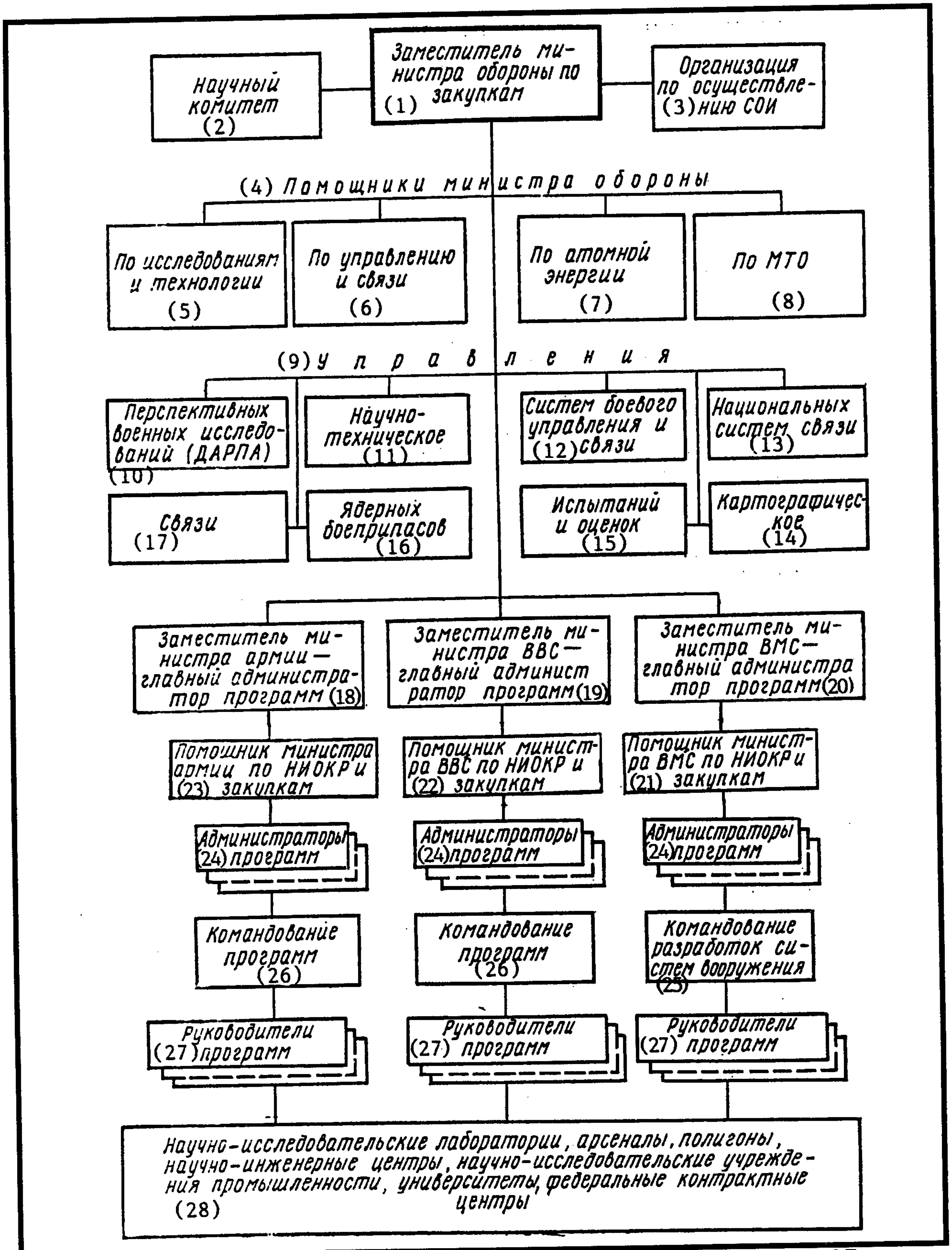

Figure 1. Organizational Structure for Management of Research and Design in the U.S. Armed Forces

implementing military policy has been undergoing reform and the decision making system has been undergoing reorganization since 1986. This reorganization pertains to a significant degree to the forms and methods of implementing programmed development of armament in the Defense Department.According to Western specialists a rather clearly organized military research and development administration has evolved as a result of the measures implemented in the USA (Figure 1). The defense undersecretary for procurement (officially the defense undersecretary for acquisition of weapons and military equipment) manages the scientific research program; he is responsible for development, testing and evaluation of armament and for development of policy concerning acquisition of large weapon systems, and he coordinates the activities of the armed forces departments in research, design and procurement. Organizationally, this undersecretary's staff is broken down into departments, and it consists of around 350 persons. The Defense Department's centraldirectorates—long-range military research (DARPA), scientific and technical, testing and evaluation, communications and others—are subordinated to him. He coordinates with the Committee of the Joint Chiefs of Staff in the planning of armament development.

Permanent and temporary scientific consultative committees, councils and working groups are an important element in the military research and design management structure.

Management of research and design is assigned in the armed forces departments to assistant secretaries for research, design and procurement (insofar as pertains to them) and program chief administrators. The latter are responsible for development and procurement programs. In issues involving programs they are subordinated directly to the defense undersecretary for procurement. Program administrators have been introduced into all of the armed forces. Several program directors responsible for developing specific weapon systems are subordinated to them. As a rule these program directors are generals and senior officers with a sufficient level of military and special technical training. They are given a key role in planning, implementing and monitoringexecution of the main phases of the programs. In the opinion of Pentagon specialists, however, effective execution of these functions would be possible only if the program directors possessed the right to dispose of financial resources allocated for development. This right was in fact granted in its entirety.

The materiel support command is concerned with weapon developments in the army and naval departments, and the weapon system development command performs this function in the air force department. Commands consist of directorates (divisions) which are responsible for designing particular types of equipment and which manage and direct the activities of the appropriate institutes, laboratories, centers and proving grounds (there are around 80 of them).

The other executors of military research and design in the USA fall into three groups of organizations: universities and colleges participating in fundamental research and development; scientific research institutions of military-industrial firms working predominantly on long-range and technical developments; federal contracting centers which conduct systems analysis of the needs of the Defense Department and its research and design policy, and of the technical and economic feasibility of major programs.

Armament is developed in the USA within the framework of a single military planning system (Figure 2). Strategic plans concerned with this problem are developed by the Committee of the Joint Chiefs of Staff (CJCS) within the framework of a joint strategic planning system, and they are implemented with regard for requirements imposed by the president on the basis of recommendations of the National Security Council. Strategic planning covers short (1-2 years), medium-range (3-9 years) and long-range (10-20 years) periods, and it entails developing a number of fundamental documents.

A joint long-range strategic estimate contains an analysis of the military, political, economic, scientific and technical factors having an influence on the ways of attaining the government's foreign policy goals. Several models of the world situation and the corresponding methods of use of the armed forces, as well as plans to support expansion of their possibilities, are examined in this case. A joint intelligence planning estimate is based on conclusions of the Defense Department's intelligence directorate having to do with the prospects for development of the international situation, the armed forces of the potential adversary and American strategic intelligence on certain regions. This estimate is used as the basis for formulating intelligence missions in support of strategic planning, which must be carried out within the next decade. The joint document for strategic planning contains conclusions and recommendations for the U.S. president, the National Security Council and the Defense Department in regard to questions of military strategy, long-range development of the armed forces and creation of the basic weapon systems. The joint memorandum on program evaluation reflects the views of the CJCS on proposals of the armed forces secretaries concerning improvement of components of these weapons allocated to the joint commands. The joint plan of strategic needs and possibilities includes instructions of the armed forces secretaries and joint and special command commanders concerning fulfillment of the tasks of resource development and use of these resources over the short range.

Documents drawn up in the course of strategic planning have the purpose of orienting all activities of the U.S. secretary of defense, including armament development, on ensuring fulfillment of the operational and strategic missions facing the country's armed forces.

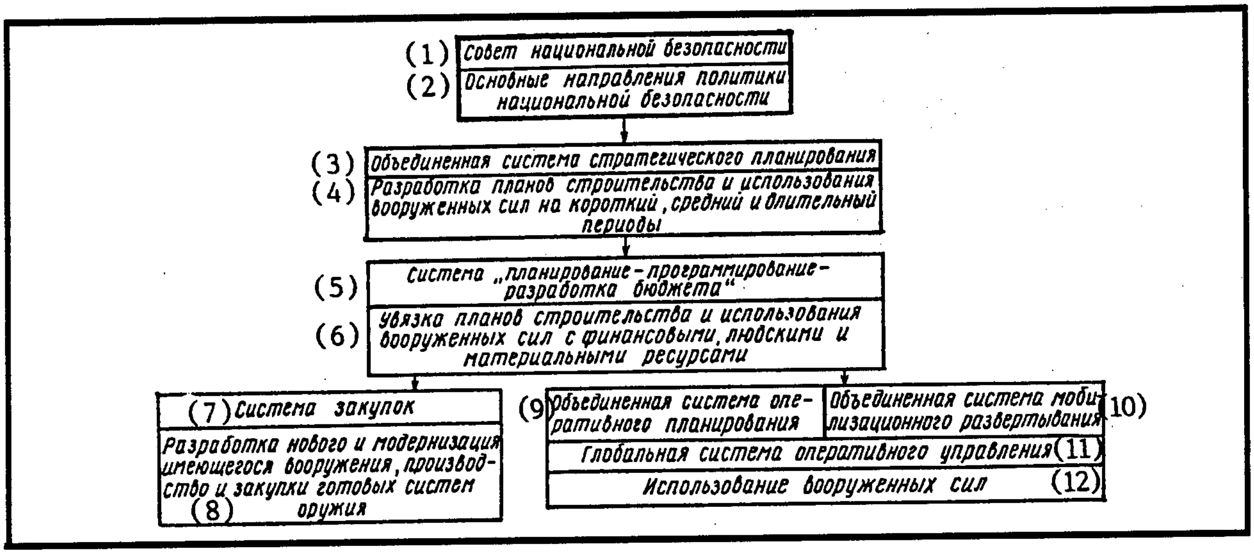

Figure 2. Unified System for Military Planning in the USA

Key:
1. National Security Council
2. Main directions of national security policy
3. Joint strategic planning system
4. Development of plans for construction and use of armed forces over short, medium-range and long-range periods
5. "Planning, programming, budget development" system
6. Coordination of plans for development and use of armed forces with financial, human and material resources
7. Procurement system
8. Development of new and modernization of existing armament, production and procurement of ready-to-use weapon systems
9. Joint operational planning system
10. Joint mobilizational deployment system
11. Global operational control system
12. Use of armed forces

In order that development of the armed forces would proceed in different periods in accordance with the available resources (this concept includes personnel, materiel support resources and armament), the Pentagon introduced the "planning, programming, budget development" system, which supports development of armament on the basis of specific programs aimed at solving this problem. In correspondence with it, all tasks arising in the course of development of the armed forces are broken down into five basic groups: "actions of strategic forces," "actions of general-purpose forces," "control, communication and intelligence," "support to solution of general problems" and "development of the scientific and technical base." They in turn are broken down into sub-tasks of lower levels. As a result a single structure of goals and tasks pertaining to armed forces development is formed in the Defense Department. The content of the main tasks is determined by the CJCS, which develops the operational and strategic criteria for assessing armament development programs, with the participation of representatives from the joint and special commands.

It was reported in the press that the requirements on expanding the combat capabilities of the troops (forces) are formulated as a rule in operational terms, and without indicating the specific weapon systems and their characteristics, which allows the developers the possibility for selecting the particular variant. It is no accident that R. Delauer [transliteration], former U.S. undersecretary of defense for research, design and technology, noted in a report to Congress in 1984 that "when it comes to planning, more attention should be devoted not to the combat characteristics of a given system but to determining our needs with regard for long-range military objectives." This is why in its planning the U.S. Department of Defense makes wide use of a term like "combat capabilities," which includes the following components: trained personnel and the resources for maintaining their training level (a training base); facilities and installations (elements of the infrastructure); expendables (POL, spare parts) and armament. And only after the areas in which combat capabilities need to be expanded are determined are the variants of attaining the proposed goals studied.

According to information in the Western press all scientific research and design is planned by the U.S. Defense Department with a rigid orientation on the requirements of military strategy and on the specific objectives determined in the course of strategic planning. In the course of its work the CJCS uses various procedures of quantitative and qualitative assessment of research and design programs.

Thus the planning stage in the "planning, programming, budget development" system includes, first of all, substantiating the need for expanding the combat capabilities of the troops (forces); second, coordinating plans for fulfilling these requirements, with regard for available resources, at the level of the defense and armed forces departments; third, selecting the variants of the plans to be implemented. The latter is a transition to the next stage.

The programming stage in the "planning, programming, budget development" system entails finding optimum ways to implement plans with minimum outlays of time and resources. The "Five-Year Program of the U.S. Department of Defense" is drawn up and refined during this stage. The program itself consists of 10 basic programs: "Strategic Forces," "Special-Purpose Forces," "Military Intelligence and Development of Communication, Observation, Surveillance and Control Systems," "Air and Sea Troop Transport Forces," "Armed Forces Reserves," "Research and Development," "Centralized Armament Supply and Repair," "Personnel Training, Medical Service and Materiel Mupport," "Administrative Activities," "Military Aid to Other Countries." Each of these programs contains elements taking the form of a package of material and financial resources, personnel and different types of activity, grouped together in relation to their specific purpose—that is, in relation to specific military objectives. The Pentagon is presently carrying out around 800 research and design program elements.

In distinction from the international practice of dividing scientific research into fundamental and applied research and development, the U.S. Defense Department has adopted a more complex classification including the following categories of scientific research and experimental design work: fundamental research (solution of problems in the natural, technical and social sciences having important significance to armed forces development); exploratory developments (analysis of the possibilities for implementing the results of fundamental research in the development of materials, processes, devices and design concepts which could lay at the basis of future weapons); long-range development (creation of experimental models of military equipment for testing and evaluation for the purposes of determining technical feasibility); technical development (manufacture of experimental models of military equipment with which to study the possibilities for making a decision on their industrial production); management and support (development of scientific, experimental and testing equipment, support and service resources and the methods of job control); modernization of weapons and military equipment (improvement of designs in the stages of introduction, series production and employment in the troops).

The program elements contained in the categories of research and design listed above are broken down into two groups. The first makes up the Defense Department's scientific and technical program, and it includes the elements of fundamental research and exploratory and, in part, long-range development associated with accumulation of scientific knowledge. As former undersecretary of defense for research, design and technology W. Perry declared, "The scientific and technical program is a source of new ideas in the area of designing weapon systems, improving existing armament and integrating scattered research directions for the purposes of supporting the state's military power." The second group is associated with full-scale development and subsequent improvement of weapon systems. Control of these program elements concerns itself with strict compliance with technical, economic and temporal indicators.

It would be sufficient to cite the following figures to get an idea of the importance the Pentagon attaches to the scientific component of the development of weapons and military equipment. On the average the share of the total amount of money spent on research and design in the period from 1979 to 1988 was around 60 percent for central directorates of the Defense Department, 12-15 percent for the army, 9-11 percent for the air force and 10-12 percent for the navy.

Programming is the binding link between military planning and development of the budget—the concluding phase of the operating cycle of the "planning, programming, budget development" system. The dimensions of the resources allocated for development of armed forces are conclusively determined, and their balanced distribution among the principal programs, the armed services and specific purposes is carried out at the time when the budget is drawn up. The Defense Department's budget includes the following items: "Maintenance of Servicemen and Pension Support," "Combat Training and Materiel Support," "Purchases of Weapons and Military Equipment," "Research, Development, Testing and Evaluation" and "Military Construction and Housing Support." It also follows the principle of distributing assets among different types of activity pertaining to different time periods: supporting operation of the armed forces in the next year (the first and second sections), and increasing military power in the more remote future (the rest of the sections).

The total amount of money allocated for research and design to armed forces departments and central directorates is distributed among three structures: departments, categories of research and design, and program complexes (Figure 3). In this case the rate of militarization of science is increasing swiftly in the USA, as is manifested in particular in the continual increase in the proportion of military research and design in Federal outlays on scientific and technical development. While in the late 1970s around half of the state assets for research and development were allocated to military research and design, over three- fourths of such assets will be spent on military research and design in the late 1980s.

American specialists feel that the "planning, programming, budget development" system generally ensures a unified approach at all levels of military and political

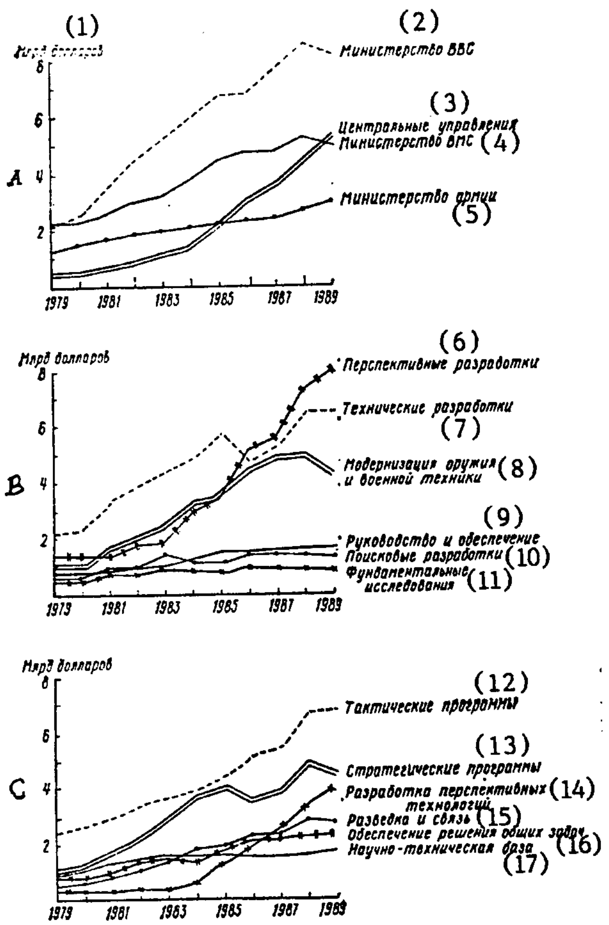

Figure 3. Distribution of Allocations to the U.S. Department of Defense for Research and Design in the Period from 1979 to 1989: A—to armed services; B—to categories of research and design; C—to program complexes

Key:
1. $billion
2. Department of the Air Force
3. Central directorates
4. Department of the Navy
5. Department of the Army
6. Long-range developments
7. Technical developments
8. Modernization of weapons and military equipment
9. Management and support
10. Exploratory developments
11. Fundamental research
12. Tactical programs
13. Strategic programs
14. Development of long-range technologies
15. Intelligence and communication
16. Support to solution of general problems
17. Scientific and technical base

leadership to preparing, justifying and adopting decisions and monitoring their execution, in relation to all problems having to do with development of the armed forces, their structure and fighting strength, with supplying weapons and military equipment, and with training the troops and maintaining their combat readiness.

Besides the "planning, programming, budget development" system, the armed forces departments of the USA also employ a so-called **appropriation system**, which is intended to provide guidance to the creation of military equipment. As we know, a certain succession of phases in a life cycle is typical of any complex technical device from the standpoint of its development over time. These phases differ significantly from one another in terms of the type of work done, its duration, the degree of scientific and technical risk and so on. The process of appropriation begins with the armed forces commands or the administration of the Defense Department confirming the need for creating a particular weapon system (military equipment), and it includes development of this system, its production, and its deployment in the troops. In other words, as defined by American specialists, appropriation is the unity of mutually related research, design and procurement programs. As these programs are carried out, the need for weapon systems is analyzed periodically, and timely adjustments are made in the course of their development. A balanced, optimum combination of the degree of fulfillment of project requirements, the time to carry out the work and the overall estimated cost of the programs is believed to be the main criterion for appropriation of the resources of armed conflict.

The typical life cycle of large military systems includes the following phases, according to the practice of the U.S. Department of Defense: investigation of the conception, demonstration and confirmation, full-scale development, production and deployment, and operation in the troops. The first four phases make up the process of appropriation. The Pentagon distinguishes between several types of programs for creating weapons and military equipment depending on the amount of money spent and the priorities. Temporary councils monitoring appropriation of systems of military equipment bear responsibility for the feasibility of initiating a program, for moving on from one phase of design to the next, or for abandoning a project. These councils are staffed by representatives of the Defense Department's central administration, the materiel support (developments) commands of the armed forces departments interested in obtaining this equipment, financial organs and other organizations.

The decision to enact a program to create a weapon system is made at the zero line (terminology adopted by the U.S. Department of Defense), following analysis of the capabilities of the troops for fulfilling the corresponding missions and study of the accumulated scientific and technical knowledge and the various options for fulfilling the arising needs. In the stage of analysis of the conception, the feasibility of the appropriation program

is determined and sketches of two or three variants of the weapons system, offered by industrial firms, are studied in order to determine the scientific and technical risk.

After the conception is analyzed at the first control line, the work of selecting an acceptable variant of the weapon system is carried out. Then in the stage of demonstration and confirmation of the conception, experimental models of the competing variants are designed and manufactured, and the prototypes are tested. After the second control line, at which the question of developing the selected variant of the weapon system in its entirety is conclusively resolved, the stage of its full-scale development begins—that is, work associated with manufacturing experimental models and testing them is organized. At the third control line the decision is made on series production and deployment of the weapon system in the troops. This ends the appropriation process.

The possibilities of the proposed weapon system for fulfilling the requirements of the adopted conception of use in the troops (forces) are analyzed at each control line. Because the process of developing weapons and military equipment usually takes a long time, adjustments in the project requirements are allowed in order to make the new system correspond more fully to changing viewpoints of the CJCS on the use of the armed forces.

Thus weapon systems undergo testing and their experimental data, obtained not only by calculation but also experimentally, are evaluated in parallel with design of the weapon systems.

The military and political leadership of the USA is constantly seeking ways of raising the effectiveness of military research and design. Increasingly greater attention has been devoted in recent years to widely introducing computer technology into research. While in 1970 the U.S. Department of Defense used around 600 general-purpose computers (approximately 18 percent of the Pentagon's entire pool) in research and design, today their number exceeds 4,000 (around 44 percent).

It was reported in the American press that from 1982 to 1990 the U.S. Defense Department will implement a "Strategic Program of Development of Computer Technology" for military purposes (the press refers to it as the "Strategic Information Initiative"). The objective is to create highly productive computers with a speed of up to 10^{10} operations per second. The tentative cost of the program is $600 million. The effectiveness of research and design is to be significantly increased by reducing the time of scientific exploration and operational assessment of results. A highly important place is given to modern science, being the first component of the "science—technology—production—operation in the troops" cycle.

Many foreign specialists feel that a new stage in the development of military equipment, often referred to as the technological stage, began in the 1980s. Its principal feature is that creation of weapon systems and their subsequent modernization and combat use proceed on the basis of continuous acquisition of new scientific knowledge. In this case the complexity of planning the development of armament grows, since uncertainty that the required results would be achieved is internally inherent to scientific research at its fundamental and exploratory stages.

American specialists look at the presently functioning "planning, programming, budget development" system and the appropriation system as integrated, multipurpose tools making it possible for the leadership of the U.S. Department of Defense to pursue a unified military technical policy. Effective control over the development of armament is ensured because the decision making process is clearly defined, and the military leadership is able to substantiate the requirements for financing the programs and to monitor their implementation. The American experience of programmed development of armament has been borrowed to a certain extent by the FRG, Great Britain, France, Japan and a number of other countries. Implementation of joint armament development programs under NATO is based in part on programmed development as well.

Improvements in the organizational forms of planning the development of weapons and military equipment occur practically continuously in the USA. Thus the mechanism for shaping and implementing military policy and the decision making system have been experiencing ongoing reorganization since 1986. This reorganization has the purpose of raising individual responsibility in all spheres of preparing and using resources in combat. The role of the chairman of the CJCS, who has become the principal figure in the planning of the main directions of development of the armed forces, has risen significantly. The role of the commanders-in-chief of joint and special commands has become stronger as well.

Steps are being taken to somewhat simplify the "planning, programming, budget development" system. American specialists feel that the "planning" and "budget development" stages will be combined in order to ensure that decisions are oriented on specific programs and that they are tied directly into the budget process. Concurrently they recommend supplementing this system with a new stage—"evaluation."

There are also plans for reorganizing the armament appropriation system. In particular one of the recommendations foresees introducing a long-range (15-year) investment plan for the Defense Department as a whole. This will promote a closer relationship between the principal missions of the armed forces and the long-range plans and programs drawn up by the departments of the army, air force and navy. Moreover this will make it possible to evaluate more precisely the long-range need for resources, and the possibilities for their acquisition. Replacing the annual budget cycle by a two-year cycle is

recommended. It has been suggested that the number of stages (control lines) of decision making in the acquisition process should be reduced from five to two.

The problems of programmed planning of armament development is constantly in the center of attention of the military and political leadership of the USA, and priority significance is attached to improving the organizational forms of creating new models of weapons and military equipment in the shortest time possible. Steps are being taken in this connection with the purpose of making the fullest and most comprehensive use of the accomplishments of modern scientific and technical progress to create highly effective weapons which, in the plans of militaristic circles of the United States, are to be used to attain military superiority over the Soviet Union and other countries of the Warsaw Pact.

The Reconnaissance and Electronic Warfare Battalion of the U.S. Armored (Mechanized) Division

18010461c Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 23-28

[Article by Lt Col V. Mosalev]

[Text] Wide use of electronic equipment in the armed forces of the principal capitalist states and growth of their role in modern combat have caused the U.S. Army command to change its views on the objectives of electronic warfare, which they define as the sum of measures and actions of the troops to reveal the enemy's electronic equipment, to jam it and to ensure stable operation of their own equipment.

It was reported in the American press that in the period from 1977 to 1986 the American command implemented a number of organizational measures in order to bring the organizational structure of electronic warfare subunits and their equipment in correspondence with requirements determining their use in modern combat. Thus a brigade consisting of three battalions was included in the army corps, a reconnaissance and electronic warfare battalion was included in the division, and a reconnaissance and electronic warfare company was included in the separate brigade and the separate armored cavalry regiment. Specialists feel that this reorganization expanded the possibilities of the troops in electronic warfare, which has now essentially transformed from a form of combat support to one of the forms of combat activities. This was also promoted by the fact that a decision was made to organize closer coordination between electronic warfare resources and troop technical reconnaissance. Such "unification," specialists emphasize, makes it possible to "see the battlefield" in real time and to provide target information to weapons promptly. Given the fluidity of modern combat, the time factor has become fundamental to success, and it imposed limits on the kind of missions that could be given to the newly formed subunits—reconnaissance of the enemy's electronic equipment and electronic suppression of the most important equipment or provision of target information for its destruction, disorganization of the enemy's control system by transmission of false reports and commands, and protection of friendly electronic equipment.

This article, which was written on the basis of foreign military press materials, illuminates the purpose, organization, armament and combat capabilities of the reconnaissance and electronic warfare battalion of the U.S. armored (mechanized) division.

Purpose

The reconnaissance and electronic warfare battalion is intended for organization of radio reconnaissance, electronic intelligence (ELINT) and electronic warfare. In today's conditions of combat activities, its resources can execute the following missions: detecting enemy electronic equipment, determining by its signature its membership to particular units and subunits, precisely determining its location and direction of travel with the purpose of providing (in real or close-to-real time) target information to fire weapons; detecting and selectively jamming the enemy's most important electronic equipment at the battalion, brigade and division levels with the purpose of disorganizing his control systems; monitoring the emissions of friendly electronic equipment and "camouflaging" them in order to ensure stable operation in the face of the enemy's electronic warfare.

Organization

The reconnaissance and electronic warfare battalion consists of four companies—headquarters and operational camouflage, electronic warfare, electronic intelligence and monitoring, and service. It contains a little more than 500 men, an M577A1 command-and-staff vehicle, nine M113A1 armored personnel carriers and various technical resources for radio reconnaissance, ELINT and electronic warfare.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center.

The headquarters section is intended for control of the battalion. The division combat control center support group assists the chief of the division headquarters reconnaissance and operations sections in analyzing reconnaissance information, organizing reconnaissance and electronic warfare, and implementing operational camouflage measures. It includes five sections—control

of reconnaissance forces, reconnaissance data processing, electronic warfare, operational camouflage and forward command post support. Besides these, the group contains weather service and topographic surveying subunits. The battalion operations center consists of an operations section and a technical control and analysis center. The operations section sends a reconnaissance and electronic warfare group to the combat control center of each of the division's brigades to coordinate the activities of the reconnaissance and electronic warfare resources allocated to a brigade for the period of combat. The technical control and analysis center maintains centralized control over the division's reconnaissance and electronic warfare resources, and generates the basic data required for organizing and conducting reconnaissance and electronic warfare. A platoon of electronic warfare helicopters from an army air division brigade and POW interrogation and operational camouflage sections are subordinated to the battalion operations center.

The electronic warfare company hunts for, intercepts, determines the bearing of, identifies and tracks enemy electronic equipment, subjects reconnaissance information to initial processing and evaluates the electronic situation and jams revealed enemy resources. The company includes a center for reconnaissance information collection and processing (installed on a motor vehicle chassis) and three intelligence collection and electronic suppression platoons. The center continually processes and analyzes information in support of detection, interception, direction finding and identification of the enemy's electronic equipment, coming from all of the division's radio reconnaissance and electronic intelligence resources.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center. The electronic intelligence and monitoring company carries out the tasks of reconnoitering targets and objectives on the battlefield in behalf of the division's units and subunits, and of providing target information to permit organization of their destruction by fire. It consists of an administration and three electronic intelligence platoons. Each platoon includes an administration and two sections—electronic intelligence and monitoring. Its armament includes a ground reconnaissance radar station and reconnaissance and signaling instruments. As a rule, the company's subunits are used in decentralized fashion, and its command post is deployed 0.5-1 km from the battalion operations center.

The service company supports the battalion with communication and provides technical and food services. It contains three platoons—communication, technical support and food support. Its armament includes wire and radio communication equipment and apparatus and equipment for repair of electronic equipment.

Armament

It is reported in the foreign military press that the subunits of a reconnaissance and electronic warfare battalion are armed with the most diverse electronic equipment making it possible to effectively conduct radio reconnaissance, ELINT and electronic warfare.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center. Radio reconnaissance, electronic intelligence and electronic warfare resources are contained chiefly in the electronic warfare company. This includes the AN/TSQ-114A automated radio reconnaissance system (Figure 1 [figures not reproduced]) and the following stations: radio reconnaissance—AN/TRQ-32(V) and AN/TRQ-37, ELINT—AN/MSQ-103A (Figure 2), electronic warfare—AN/MLQ-34 (Figure 3), radio reconnaissance and ELINT—AN/TLQ-17A (Figure 4) and others. The AN/ALQ-151 ELINT and electronic warfare station, installed in the EH-60H Black Hawk helicopter, and other equipment provided to the battalion and division as a whole for the time of combat activities may be used to raise the effectiveness of reconnoitering, direction finding and jamming enemy electronic equipment. The basic characteristics of this equipment are shown in Table 1.

Radar equipment is supplied to the electronic intelligence and monitoring company. It includes ground reconnaissance radar stations, including the hand-carried AN/PPS-15 (Figure 5), the portable AN/PPS-4A and -5 (Figure 6), the AN/TPS-33 portable instrumental artillery reconnaissance radar station and the vehicle-transported AN/TPS-25 and -28. Their characteristics are given in Table 2.

Foreign military specialists note that these radio stations can detect and identify (depending on the roughness of the terrain) moving enemy personnel at ranges up to 10 km, and combat equipment at ranges up to 20 km. They are used chiefly in the combat formations of first echelon subunits, where they carry out the following tasks: radar observation of the forward edge and the approaches to it to a depth of 5-10 km from the line of contact of the belligerents, target indication for fire weapons, and radar cover of gaps and important rear facilities of the division. A total of 50 such radar stations may be used within a division's zone of operations.

Reconnaissance and signaling equipment is supplied to the electronic intelligence and monitoring company. It consists of various types of reconnaissance and signaling instruments, including: seismic (AN/GSQ-139, -151, -154, -155 and -158), acoustic (AN/GSQ-117, -161 and DT383), magnetic (AN/GSQ-180, DT368, DT509, DT514 and DT516), electromagnetic (AN/GSQ-160), infrared (AN/GSQ-135 and -171), mechanical

Table 1. Radio Reconnaissance, ELINT and Jamming Systems and Resources of the U.S. Armored Division (Mechanized Division)

Тип (1)	(2) Диапазон частот, мГц / точность пеленгования, град (3)	Мощность излучения, кВт (4)	Дальность действия, км (5)	Дальность развертывания от линии соприкосновения войск, км (6)	Время развертывания, мин (7)	Носитель (8)
AN/TSQ-114A	0,5 — 150 / 2	—	30	3 — 15	10	5 гусеничных (12) транспортеров (2 пункта перехвата и управления, 3 дистанционно управляемых радиопеленгатора)
AN/TRQ-32(V)	0,5 — 150 / 2 — 3	—	30	3 — 5	30	(13) 1,25-т автомобиль
AN/MSQ-103A	500 — 40 000 / 1	—	30	3 — 6	30	Гусеничный транспортер (14)
AN/ALQ-151	1,5 — 80 / 3 — 5	(9) До 0,15	100	15	(10) С ходу	Вертолет EH-60H «Блэк Хок» (15)
AN/MLQ-34	20 — 150 / —	1,3	25	3 — 5	(11) С короткой остановки	Гусеничный транспортер (14)
AN/TLQ-17A	1,5 — 80 / —	0,55	20	1 — 3	С ходу	Гусеничный транспортер или 0,25-т автомобиль (16)

Key:
1. Type
2. Frequency range, mHz
3. Direction finding precision, degrees
4. Radiating power, kW
5. Range, km
6. Distance from deployment site to troop line of contact, km
7. Deployment time, min
8. Vehicle
9. Up to
10. On the move
11. During a short halt
12. Five tracked transporters (two interception and control points, three remote-controlled radio range finders)
13. Motor vehicle
14. Tracked transporter
15. EH-60H Black Hawk helicopter
16. Tracked transporter or 0.25-ton motor vehicle

(AN/GSQ-134 , -177 and T-1151/GSQ), and controlled seismoacoustic (capable of detecting enemy personnel at 30 m and combat equipment at 300 m, of transmission of detection signals over a distance of up to 20 km and, using relay stations, up to 100 km). In addition there are REMBASS reconnaissance and signaling instruments (Figure 7): magnetic—DT561, seismoacoustic—DT562 and DT563, and infrared—DT565. They can detect enemy personnel at 50 m and combat equipment at 350 m, and they can transmit detection signals to distances of up to 20 km and, using relay stations, up to 100 km. In the future this system is to be supplemented with electronic signaling instruments (mechanical—DT573, and seismic—DT567 and DT570) delivered by airborne equipment and by 155-mm artillery projectiles. Receivers (AN/GSQ-187 and R-2016/GSQ) and portable monitors are used to receive and monitor signals.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center. In the opinion of American specialists, reconnaissance and signaling instruments economize on the resources needed to conduct reconnaissance and observation of the enemy. They can be used to "observe" roads, water obstacles, crossings and assaultable areas, and to cover minefields and other artificial obstacles.

Capabilities of a Reconnaissance and Electronic Warfare Battalion

It is reported in the foreign press that a battalion's organic equipment makes it possible to conduct reconnaissance of enemy shortwave and ultrashort-wave radio communications (0.5-150 mHz range) and radar equipment (500-40,000 mHz) and create interference to the work of radio communication equipment (1.5-150 mHz). It is noted that most of this equipment is to be used in the combat formations of battalions in the

Table 2. Ground Observation Radar Stations of the U.S. Armored Division (Mechanized Division)

Тип РЛС (1)	Дальность обнаружения, км (2)		Точность определения координат (5)		(8) Способ транспортировки / рабочее положение (9)	(10) Расчет, человек / время приведения в рабочее положение, (11) мин
	человека (3)	боевой техники (4)	по дальности, м (6)	по азимуту, град (7)		
AN/PPS-4A	3,5	7	±25	±0,6	Ранец (12) / тренога (13)	3 / 10
AN/PPS-5	6	10	±20	±0,6	Ранец, автомобиль (14) / тренога, автомобиль (15)	3 / 7 — 10
AN/TPS-25	4,5	20	±23 — 75	±1,14	Автомобиль (16) / автомобиль	3 / 15 — 45
AN/TPS-33	6,5	18	±23—75	±1,2 — 1,4	Автомобиль / автомобиль	3 / 10 — 15
AN/TPS-58	10	20	±20	±0,6	Гусеничный транспортер (17) / гусеничный транспортер	3 / 5

Key:
1. Type radar station
2. Detection range, km
3. Person
4. Armored equipment
5. Coordinate determination precision
6. Range, m
7. Bearing, degrees
8. Transportation method
9. Working position
10. Crew, persons
11. Time to place in working position, min
12. Backpack
13. Tripod
14. Backpack, motor vehicle
15. Tripod, motor vehicle
16. Motor vehicle
17. Tracked transporter

division's first echelon. It is to be located up to 5 km from the line of contact of the belligerents and, when installed aboard helicopters, at a range of up to 15 km. Thus radio reconnaissance and electronic intelligence equipment can conduct reconnaissance at a range of up to 30 km within the enemy's combat formations, while electronic intelligence equipment can suppress enemy radio communications within 15-25 km, and to a range of up to 85 km when installed aboard helicopters.

It takes 10-30 minutes to deploy ground radio reconnaissance and electronic intelligence apparatus. Locating electronic suppression equipment not less than 1.5 km from radio reconnaissance and electronic intelligence subunits is recommended. Emission time should be 3-8 sec, and time at one position should be not more than 10-15 min.

Expendable jammers delivered by artillery projectiles are to be used in order to increase the effectiveness of electronic suppression of the enemy's radar. Helicopter equipment with a range of up to 15 km is also under development.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center.

American specialists feel that division reconnaissance and electronic warfare equipment does not satisfy the requirements of modern combat, inasmuch as its range is insufficient and its vulnerability is high (this is especially true of jamming equipment). According to the principles of the "air-ground operation (engagement)" conception, the zone of a division's combat pressure within which reconnaissance is conducted chiefly to determine the locations of the enemy's principal installations is 70 km into the enemy's combat formations, while the zone of potential threat, in which the enemy's actions are tracked in the interests of planning and organizing subsequent combat activities, is up to 150 km. Reconnaissance at such ranges is possible only by division electronic intelligence equipment installed aboard airplanes or helicopters.

The Control System

The system for controlling the resources of a reconnaissance and electronic warfare battalion has the purpose chiefly of coordinating the actions carried out by all of its organic and attached subunits to obtain information on the enemy and to organize effective countermeasures to his electronic equipment. Its main organs are the staff, the battalion command post, which interacts most intimately with the division combat control center when it comes to developing reconnaissance and electronic warfare measures, calculating the necessary resources and

assigning missions, the battalion operations center and the center for technical monitoring and analysis. Much attention is devoted to organizing dependable communication ensuring continuous and covert control of the battalion's resources. Six radio nets (ultrashort-wave in telephone mode) are to be created in the battalion for the time of combat: the battalion commander's, the battalion operations center's, three operational, and one administrative.

The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center.

The battalion commander's radio net is intended for management of subordinated subunits. It includes the following radio stations: the battalion commander's (main), the operations center's, and those of the commanders of the companies and the communications platoon. Relay stations are used when necessary.

The battalion operations center's radio net is used to transmit instructions on combat use of ELINT and jamming resources, and reconnaissance information. It includes a radio station (the main station), the command post radio station, and the radio stations of subunits subordinated to the center.

Operational radio nets are used to support the communications of each of the companies with the battalion operations center and the brigade headquarters to which the subunits are attached.

The administrative radio net provides for management, control and coordination of supply and service of the battalion's subunits. It includes the radio stations of the battalion deputy commander, the rear services chief (the main station), the commanders of the headquarters and administrative, electronic warfare and electronic intelligence and monitoring companies, and a relay station. The main radio stations of the battalion radio net are included within the radio nets of the corresponding division chiefs and control organs.

On the whole, in the opinion of American military specialists, the existing organization and equipment of the reconnaissance and electronic warfare battalion make it possible to carry out the missions of detecting and The headquarters and operational camouflage company organizes control over the combat activities of the battalion's subunits and monitors the operating modes of electronic equipment. It includes a headquarters section, a division combat control center support group and a battalion operations center. suppressing the enemy's electronic equipment.

Crossing Equipment of NATO Armies

18010461d Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 28-36

[Article by Col L. Sergeyev]

[Text] When it comes to carrying out the complex of tasks associated with engineer support to combat activities, the command of the NATO bloc devotes special attention to crossing water and other terrain obstacles without reducing the rate of advance of its troops. In the opinion of Western military specialists this is extremely important for two basic reasons: presence of a large number of water obstacles of various widths in the European theater of war, and the need for ensuring high mobility of troops on the battlefield.

Since the early 1980s the number of publications dealing with the development and use of existing and future crossing equipment increased noticeably in the foreign military press. This was chiefly because the crossing resources presently possessed by engineer troops of the NATO armies does not fully satisfy today's requirements, and they require replacement by more effective models.

In the course of the last decade the USA, the FRG and Great Britain conducted joint efforts to create the system of crossing equipment for the 1980s. However, owing to differences in project requirements and lack of money, this research program was terminated, and now each of these countries is conducting further work on the basis of national programs. In this case Western military specialists feel that the troops need three basic types of crossing equipment[1] to cross water obstacles because of the conditions under which this equipment is employed in combat and because of the volume of missions that must be carried out:

—tank bridgelayers—to support the mobility of tank and mechanized units in forward areas;

—self-propelled and conventional (nonself-propelled) pontoon bridge trains—used by the troops to cross wide water obstacles;

—bridges on rigid supports (mechanized and prefabricated) to cross water obstacles by support units and subunits and services following the forward detachments.

Tank Bridgelayers

Tank bridgelayers (Table 1) are intended to be used under direct enemy fire. They are mounted on the chassis of the principal fighting tanks, and they are able to travel within the combat and march formations of tank units and subunits.

The most widespread model of vehicles of this class is the American AVLB tank bridgelayer (Figure 1 [figures

Table 1. Combat Characteristics of Tank Bridgelayers

Наименование образца (страна-разработчица) (1)	База (танк) (2)	(3) Масса, т / экипаж, человек (4)	(5) Размеры моста, м: длина / ширине	(6) Время, мин: укладки моста / снятия	(7) Мощность двигателя, л. с.	(8) Скорость хода, км/ч
AVLB (США) (9)	M60A1	50/2	19,2/4	3/10	750	48
HAB (США)	M1 «Абрамс» (13)	56/2	32/4	5/10	1500	70
«Бибер» (ФРГ) (10)	«Леопард-1» (14)	45/2	22/4	5/10	830	62
FV4205 (Великобритания) (11)	«Чифтен» (15)	53/3	24,4/4	3 — 5/10	700	40
Тяжелый (Франция) (12)	AMX-30	40/3	22/4	8/10	720	50

Key:
1. Model (developing country)
2. Chassis (tank)
3. Weight, tons
4. Crew, persons
5. Bridge dimensions, m: length/width
6. Time to lay/remove bridge, min
7. Engine horsepower
8. Speed, km/hr
9. USA
10. Biber (FRG)
11. Great Britain
12. Heavy (France)
13. Abrams
14. Leopard-1
15. Chieftain

not reproduced]), which is found in many armies of the capitalist states. It is carried by an M60A1 tank chassis, and it has a folding steel bridge design consisting of two half-spans. The controls are hydraulic drive. The vehicle is designed to surmount obstacles up to 18 m wide, and it can accommodate heavy equipment weighing up to 54 tons.

The USA is presently devoting special attention to developing the HAB (Heavy Assault Bridge) heavy tank bridgelayer, work on which began in the late 1970s. It is intended chiefly to accommodate series M1 Abrams tanks. The Israeli company Israel Military Industries, which developed the bridge design, is taking part in research concerned with its creation. Owing to the use of light alloys and composite materials the length of the triple-section track bridge design was increased to 32 m while simultaneously increasing the loading capacity. In compliance with the requirements imposed on this bridge, the bridge laying and removing mechanism will also make it possible to use the bridging structure of the AVLB bridgelayer in the HAB. The first experimental model of the new American tank bridgelayer was submitted for testing in late 1986. It is anticipated that it will begin reaching the ground troops in the mid-1990s.

The Bundeswehr is armed with the Biber tank bridgelayer (Figure 2), which is created out of a Leopard-1 tank chassis. In contrast to all other vehicles intended for this purpose, it carries an extensible track bridge structure, use of which reveals the location of a crossing area to a lesser degree because when the bridge is laid, it is not raised to any great height, as is the case with bridges with the scissors design. The vehicle bears a bulldozer blade on its front to clear routes of travel and set up approaches to the obstacle. It is also used as an intermediate support when laying a bridge structure over an obstacle. The vehicle can set up a crossing over an obstacle up to 20 m wide for all types of combat equipment. The Biber bridgelayer is also supplied to engineer troops in Canada, the Netherlands, Norway and Turkey.

The FV4205 tank bridgelayer (carried by a Chieftain tank chassis) carries two types of bridge structures—No 8 (24.4 m long) and No 9 (13.4 m long). The first has a scissors design, and it consists of two half-spans, while the second is a nonfolding type. They are both made from a high-strength light alloy, they are intended for loads of up to 54 tons, and they can span obstacles up to 23 and 12 m wide respectively. The mechanism for control of the bridgelaying operation is equipped with hydraulic drive. The crew can lay the bridge and remove it from the obstacle without leaving the vehicle.

The French heavy tank bridgelayer is carried on the tracked chassis of an AMX-30 tank, and it is designed to move combat equipment over obstacles up to 20 m wide. It has a scissors bridge design consisting of two half-spans. The width of the roadway can be increased to 4 m by securing special components. The bridgelayer is equipped with a hydraulic system to control the bridge laying and removing mechanism, and it may be used on obstacles with uneven banks.

Tank bridgelayers have also been created in Italy and Spain. They have a scissors bridge design (developed by

Italy's Astra Company) with hydraulic drive. They can be carried by M47, M48, M60 or Centurion tank chassis. The width of the obstacle may be up to 20 m.

The ground troops of the Netherlands are supplied with tank bridgelayers riding on Centurion tank chassis and possessing the bridge design of the American AVLB bridgelayer.

Self-Propelled and Conventional Bridge Trains (Table 2)

This is felt to be the principal equipment in NATO armies to be used by the troops to set up crossings over wide water obstacles. As a rule self-propelled bridge trains are supplied to corps engineer subunits, while conventional bridge trains are supplied to division and brigade engineer subunits. All existing models of self-propelled bridge trains were adopted by the armies of the developing countries in the 1960s. In the opinion of foreign specialists they no longer satisfy modern requirements, they are hard to operate and service, they are expensive, and they can be incapacitated easily.here

The American MFAB-F self-propelled pontoon bridge train consists of 16 bridge and 8 ramp amphibious vehicles, the welded aluminum hulls of which simultaneously perform the role of pontoons. The vehicle has a 335 horsepower diesel engine for a propulsion unit, and motion in water is effected by a screw propeller. Traveling speed is up to 56 km/hr on land and 14 km/hr on water. The removable interchangeable hydraulic drive elements of the superstructure are above the hull. Transportable ferries or a floating bridge can be assembled out of a bridge train outfit. When the superstructure elements of several vehicles are joined together, a roadway accommodating combat equipment forms. To reduce resistance in water, the wheels of the amphibious vehicles are raised into recesses in the hull. Outfits of the MFAB-F self-propelled bridge train are now present in ground troop army corps of the USA. In the future, it was noted in the foreign press, this crossing equipment may be replaced by the Ribbon Bridge tactical pontoon bridge train.

In contrast to the previous model, the West German M2 self-propelled pontoon bridge train consists of only one type of amphibious vehicles—bridge vehicles. Each of them has a welded hull with retractable wheels and two rigid swinging floats on the sides. The superstructure outfit is carried above the hull. Crane equipment carried by the vehicle facilitates deployment of the superstructure. In order to raise mobility in water, control columns equipped with screw propellers are installed at the bow and stern of the vehicle. A standard bridge train outfit includes 12 M2B amphibious vehicles.

This bridge train is also supplied to the engineer regiment of the British 1st Army Corps, stationed in the FRG. Inasmuch as English ground troops received the heavier Challenger tanks, the loading class[2] of this bridge train was increased to 70 by adding inflatable floats to its amphibious vehicles (Figure 3).

Considering the need for supplying more effective equipment of similar purpose to engineer troops of the Bundeswehr, West German specialists are developing the new M3 self-propelled bridge train, which is to be adopted in the mid-1990s. In comparison with the existing model it will have better technical characteristics, it will require lower labor outlays for its operation and technical maintenance, and it will be cheaper. In the opinion of experts, using the new M3 bridge train to assemble a floating bridge 100 m long or a loading class 60 transportable ferry will make it possible to reduce personnel by 50 percent and decrease the quantity of vehicles needed by a third. The separate vehicle of an M3 bridge train, the hull and rigid swinging floats of which will be made from light aluminum alloy, must have all-wheel drive and all-wheel steering. This will raise its mobility over ground, despite somewhat larger dimensions in comparison with the vehicle of the M2 bridge train. In addition use of a water-jet in place of a screw propeller will provide a possibility for employing vehicles of the M3 bridge train in shallow water.

French engineer troops have been equipped with the Zhillua self-propelled pontoon bridge train since 1962. It includes 12 bridge and 6 ramp amphibious vehicles. In contrast to the American and West German models, this bridge train's amphibious vehicle has inflatable floats on its sides to increase buoyancy. This unique design feature requires around 1 hour of additional time to prepare the vehicle for entry into water, which significantly increases the crossing set-up time. Each vehicle carries a hydraulic drive superstructure member. It is propelled on water by a screw propeller installed on a swinging control column at the bow of the hull.

The Zhillua self-propelled ferry differs insignificantly in structural respects from the amphibious vehicle of a pontoon bridge train. Besides lateral floats, it also has an inflatable float beneath the on-ramp. It would take two such ferries joined together along their sides to cross heavy equipment (for example an AMX-30 tank). Striving to increase the loading capacity of a single vehicle and reduce the time required to prepare it for entry into the water, French military specialists modernized the basic variant of the model and created the series 2 Zhillua self-propelled ferry (Figure 4), which was adopted in 1985. Its loading capacity was increased to 45 tons, which permits it to carry an AMX-30 tank in one trip. Presence of a 250 horsepower diesel engine allows it to generate a road speed of up to 60 km/hr on land and a speed of 20 km/hr on water. Owing to a new method of attachment of inflatable floats and fast conversion to working position, the time it takes to prepare the ferry for entry into the water was decreased to 5 min (it was 60 min for the old model). The total demand of French ground troops for the series 2 Zhillua self-propelled ferry is estimated at 60 units, which may be supplied by the early 1990s.

Table 2. Combat Characteristics of Pontoon Bridge

Model (Developing Country)	Loading Class	Floating Bridge Dimensions, m Length	Roadway Width	Assembly Time, Min	Assembly Team, Persons	Table 2 Remarks
		Self-Propelled				
MFAB-F (USA)	60	122	4.1	20	Vehicle crews	A standard transportable ferry is assembled out of three vehicles
M2 (FRG)	60	104	5.6	60	"	Permissible current velocity 3 m/sec
Zhillua [transliteration] (France)	60	112	4	60	"	It takes 60 min to prepare the vehicles for entry into the water
		Conventional				
Ribbon Bridge (USA)	60	212	4.1	40	Company	A standard transportable ferry consists of two river and two bank units
FSB (FRG)	60	135	4.1	70	"	Four transportable ferries are assembled from one bridge train outfit
TA-1 mechanized (France)	60	100	4	45	45	The transportable ferry is assembled by a team of 21 persons in 20 min
Airliftable (Great Britain)	16	58	3.3	90	Two platoons	Permissible current velocity 1.5 m/sec

In 1987 engineer units of the French ground troops adopted the EFA self- propelled pontoon bridge train (formerly designated the MAF-2). The outfit includes four ferry-bridge vehicles with hulls made from light aluminum alloy, which serve as pontoons. The loading capacity of one vehicle is around 90 tons. The required buoyancy is provided by inflatable floats along both sides of the hull and beneath the two folding ramps. A floating bridge is assembled out of the ferry-bridge vehicles, while a separate vehicle can be used as an independent crossing resource—a ferry (see color insert [not reproduced]). Propulsion on water is effected by two Shottel [transliteration] water- jet engines at the bow and stern of the ferry. A 700 horsepower diesel engine serves as the propulsion unit, generating a land speed of 60 km/hr (12 km/hr on water). Eighty-five ferry-bridge vehicles are to be purchased for the ground troops. When they reach the engineer subunits, they will replace amphibious vehicles of the Zhillua self-propelled pontoon bridge train.

The TA-1 mechanized pontoon bridge train is a replacement for the obsolete American M4T6 and class 60 American bridge trains. It consists chiefly of folding bridge and ramp units carried on special flatbed semitrailers towed by truck tractors. The units are shifted from transport to working position, lowered onto the water and reloaded by means of a special hydraulic drive mechanism. To facilitate assembly of ferries and floating bridges (Figure 5), each bridge unit has two built- in outboard engines, which preclude the need for motorized tugboats. The design of the ramp units permits contact with a bank up to 2 m above the water level. A floating bridge 100 m long can be laid by a team of 45 persons in 45 min. A loading class 60 transportable ferry (three bridge and two ramp units) can be assembled by a team of 21 persons in 20 min).

In the opinion of some Western military specialists conventional pontoon bridge trains occupy an intermediate position between tank bridgelayers and the crossing equipment used on lines of communication in the rear zone. Their principal merits are the possibility for assembling transportable ferries and floating bridges of considerable length, and their relatively low price. Prior to the mid-1970s engineer troops of most NATO armies were equipped with American M4T6 and class 60 non-self-propelled pontoon bridge trains and West German class 16/30/50 and Holplatten [transliteration] bridge trains. The principal shortcomings of these resources were the cumbersomeness and great weight of the equipment, the considerable assembly time and the large quantity of transportation resources required to transport the assembly and maintenance teams. Presently these bridge trains are basically stored as a reserve at depots, inasmuch as new, improved models have been developed to replace them.

In 1972 the engineer troops of the USA adopted the Ribbon Bridge tactical pontoon bridge train intended to be used by first echelon troops to cross wide water obstacles. It has a number of advantages over the models mentioned above, the principal ones of which are the much lower crossing set-up time, and sharply lower labor outlays associated with assembling transportable ferries and laying floating bridges. The outfit of this bridge train, which is supplied to the bridge company of a division's engineer battalion, includes 30 river (bridge) and 12 bank (ramp) folding units made out of light aluminum alloy, and motorized tugboats. Each unit consists of four pontoons—two middle and two end pontoons, which are hinged together. They are carried in folded configuration aboard 5-ton M812 trucks, and they are unfolded into working position as they are dropped onto the water. Their upper surface serves simultaneously as a roadway. One bridge train outfit can be used to lay a floating bridge 212 m long or to assemble six transportable ferries.

Considering the obvious merits of the new crossing equipment, the command of the Bundeswehr purchased the license for its production. It has been supplied to the FRG's ground troops since 1977 as the FSB system (Figure 6), which has a somewhat different set of components—18 river and 8 bank units, and 12 motorized tugboats. Some changes were introduced into the design in order to improve technical characteristics and make operation easier. In 1987 the FRG demonstrated the latest modification of this pontoon bridge train—the FSB 2000. It is noted that around 1 hour is required to assemble a floating bridge 100 m long.

There are three types of conventional pontoon bridge trains in the engineer troops of British ground troop subunits—heavy (class 80), light (30) and airliftable (16). The first two models, which were adopted by the troops in the early 1960s, are believed to be obsolete. Both bridge trains consist of closed pontoon sections to which units of the superstructure girders are secured. They are intended to convey wheeled and tracked equipment weighing up to 72 and 27 tons respectively over wide water obstacles. Floating bridges and transportable ferries may be assembled out of the bridge train outfits. The ferries may be propelled on water by motorized tugboats or outboard engines.

The airliftable pontoon bridge train is the sole model designed specially for engineer subunits of the airborne troops. Its loading capacity is low, and it is intended for light military equipment. A bridge train consists of bridge and ramp pontoons (made from a light alloy) equipped with inflatable floats. The upper part of the pontoons simultaneously serves as a roadway. A transportable ferry and a floating or single-span bridge can be assembled out of a bridge train outfit. The single-span bridge (15 m long) is assembled on shore and moved to the obstacle by means of roller bearings and a launching nose. The transportable ferry is equipped with four outboard engines for propulsion over water. The equipment of an airliftable bridge train may be delivered to the area of use by air and dropped by parachute.

Mechanized and Prefabricated Bridges

Efforts to create future models of mechanized bridges of various loading capacity intended for use in forward areas have been activated in recent years in the principal NATO countries.

Over 50 PAA self-propelled mechanized bridges, to be used by second echelon troops to cross obstacles up to 20 m wide, were delivered to engineer units of French army corps and armored divisions in the early 1980s. The wheeled transport vehicle weighs 34 tons. A two-section bridge structure (total length 22 mm) and a ramp (5 m) are secured to it. The hull of the vehicle can be used as a bridge component (the wheels are retracted). The bridge structure employs hydraulic drive. It takes around 10 minutes to lay a single-span bridge.

Specialists of West Germany's Krupp and MAH developed the Leguan [transliteration] loading class 60 wheeled bridgelayer (Figure 7) intended to be used by heavy fighting vehicles over water and other obstacles up to 24 m wide. The requirements associated with developing crossing equipment for the 1980s were accounted for in its creation. The vehicle makes wide use of standard units and machine units from existing motor vehicles. The Leguan is carried on the chassis of a four-axle truck bearing a reinforced frame on which the bridge structure laying and removing mechanism is installed. An openwork girder with an intermediate support and an extensible track bridge structure (consisting of two half-spans) are carried on this frame as well. The total weight of the bridge structure is around 10 tons.

The overall dimensions of the Leguan wheeled bridgelayer in transport configuration are length 13.4 m, width 4 m and height 3.9 m. All actuators and devices work with the assistance of a hydraulic system during the bridgelaying operation. It takes 6 minutes to lay a bridge over an obstacle. The length of the bridge in working position is 26 m, and the track width is 1.55 m. A 350 horsepower diesel engine that can generate a road speed of up to 70 km/hr is used as the propulsion unit. In the opinion of foreign specialists the Leguan wheeled bridgelayer has good cross country capabilities and a large range (up to 700 km). It is to be used chiefly in the absence of direct fire pressure from the enemy, inasmuch as neither the crew (two persons) nor the most important elements of the hydraulic system are protected from small arms fire or artillery and mortar shell fragments. The first lot of Leguan bridgelayers (14 units) has already been purchased for Norwegian ground troops. Acquisition of another 12 such bridgelayers is planned later on. The deliveries are to be completed in 1993.

West Germany's Dornier developed the FFB 54-ton single-span bridge capable of spanning an obstacle up to 40 m wide. The outfit includes a bridgelaying motor vehicle and four trucks carrying two ramps and four bridge sections. A separate bridge section consists of two box-section tracks stored for transportation beneath the track decking on the long axis. The bridge is assembled on a guide beam by means of the crane equipment of the bridgelaying vehicle. A team of 11 persons assembles the bridge in 1 hour. In mid-1987 an experimental model of the bridge was tested for the first time in the field. According to reports in the foreign press the plan is to complete the tests by early 1989, after which series production of the bridge is to begin.

English military specialists are currently developing a family of crossing equipment for the 1990s, named the BR90 system. The plan is to employ identical modules for the bridge structures of tank bridgelayers and for assembly of mechanized bridges.

The first component of this system is three loading class 70 bridge structures: No 10 (26 m long), and No 11 and No 12 (16 and 13.5 m respectively). All three models intended to replace bridge structures No 8 and No 9 used with the FV4205 tank bridgelayer can accommodate combat equipment weighing up to 63 tons. The last two bridge structures (nonfolding type) are carried in tandem on a bridgelayer, which makes it possible to set up crossings over two obstacles or across one in two places. When two bridge structures are used, an intermediate support may be employed, especially when relatively wide but shallow obstacles must be surmounted.

The second component of the BR90 system is the mechanized equipment used to assemble the bridge. With it, a crossing can be set up over an obstacle much faster with significantly lower labor outlays in comparison with existing models. This equipment includes a truck with a crane and transportable sections of the guide beam (Figure 9), and motor vehicles carrying the track sections. When a crossing is to be set up, the vehicle bearing the crane approaches the obstacle in reverse. The guide beam sections (each 6 m long) are joined together, and then the beam is moved over the obstacle with the assistance of an intermediate support. After this the crane is used to assemble the bridge tracks on the beam. The beam is moved forward over the obstacle section by section. After the bridge is assembled, the span is lowered, and the space between the tracks is filled with panels. English specialists are now studying the possibility of employing composite material to make the guide beam in order to increase its length while simultaneously raising its carrying capacity. Creation of the BR90 system is to be completed this year.

The USA is developing the LAB (Light Assault Bridge) light mechanized bridge specially for light infantry divisions. It is designed to accommodate combat equipment and transportation resources crossing an obstacle up to 22 m wide. It has a three-unit bridge structure with a track roadway made from light aluminum alloy. A special double-axle trailer carries the equipment. Besides the bridge structure, the actuating elements of the hydraulic bridge laying and raising system are installed on it. A tracked or wheeled vehicle can be used to tow the

LAB mechanized bridge, while when long distances are involved, it will be delivered by military transport aircraft. This bridge is to be adopted by the U.S. Army in the late 1980s. A total of 200 such bridges are to be purchased.

The armies of most NATO countries presently have two types of prefabricated bridges: The American M2 Bailey bridge system and the English MGB medium girder bridge. The former was created following World War II, and it is said to be obsolete. It is found in the troops chiefly in corps engineer subunits, or in storage in depots. The Bailey system can be used to assemble single- and multispan bridges on rigid supports. A company-strength team can assemble a bridge 50 m long with a loading capacity of 72 tons in 19 hours out of one outfit. An outfit is carried by 25 motor vehicles.

The English MGB girder bridge (Figure 10) has enjoyed the widest acceptance in recent years. Its principal merit is the possibility for carrying out all of the work operations by hand, without the need for load lifting mechanisms, inasmuch as the heaviest component weighs around 270 kg, and it may be carried by a team of six persons. A single-span bridge 30 m long with a loading capacity of 54 tons can be assembled out of the basic outfit by a team of 25 persons in 1 hour. The bridge is assembled on shore and moved over the obstacle by means of a launching nose. A chain reinforcing outfit (the Americans use a cable outfit) and an intermediate support were developed to permit the MGB system to span a wider obstacle. The reinforcing outfit makes it possible to increase the length of the bridge span to 49 m while maintaining the same loading capacity. The intermediate support and the connecting device provide a possibility for assembling multispan bridges. The intermediate support weighs 5 tons, and the connecting devices and anchoring weigh 7 tons. One more squad would be required to assemble the support.

The range of use of the MGB medium girder bridge expanded significantly following development of open pontoons equipped with a diesel engine and a water-jet. It can be used together with the equipment of the MGB medium girder bridge to assemble transportable ferries and floating bridges.

Since the mid-1980s, some NATO countries have been making an effort to eliminate two of the principal shortcomings of prefabricated bridges: The bridge assembly time is being decreased, and the size of the team required to assemble and service the bridge is being reduced. Western military specialists are trying to solve these problems chiefly by mechanizing the work operations. The greatest success has been reached in this area in Great Britain and the FRG.

Besides the models examined above, NATO armies are armed with other crossing equipment, particularly light and heavy transportable ferries.

The work being done in these countries to create improved crossing equipment is evidence of the desire of the military leadership to provide the ground troops with everything they need for intensive, mobile combat activities.

Footnotes

1. This article does not examine light equipment (various boats, foot bridges and light transportable ferries) used by infantry subunits in the first troop echelon.—Editor

2. Loading class is expressed in American "short" tons (a metric ton multiplied by 0.9). In this case loading class 70 would mean a loading capacity of 63 tons.—Editor

The Portuguese Air Force

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[Article by Col V. Sibiryakov]

[Text] The Portuguese Air Force was created as an independent armed service in 1952. Air units and subunits of the ground troops and the navy and airborne troops were placed within its composition. It became an important tool in the hands of the country's reactionary circles from the first days of its existence. In its time, the air force took an active part in combat activities against patriotic forces in Angola and in other, so-called "transoceanic possessions" of Portugal. Much attention is devoted to improvement and development of the air force by the country's military leadership and the NATO bloc.

Considering Portugal to be one of the most important regions through which strategic transfers of troops and aviation from the North American continent to European theaters of military operations and the Near East would be effected, the USA and its principal NATO allies are providing significant assistance to increasing the combat capabilities of all Portuguese armed services, including the air force.

Information on the missions, organization, composition, basing, personnel training, combat training of units and subunits and the prospects for development of the Portuguese Air Force is provided below on the basis of data from foreign publications.

Missions, Organization and Effective Combat Strength

According to evidence in the foreign press the Portuguese military leadership has given the air force the following missions: providing direct air support to ground troops and the navy, conducting air reconnaissance, providing for the country's air defense, airlifting

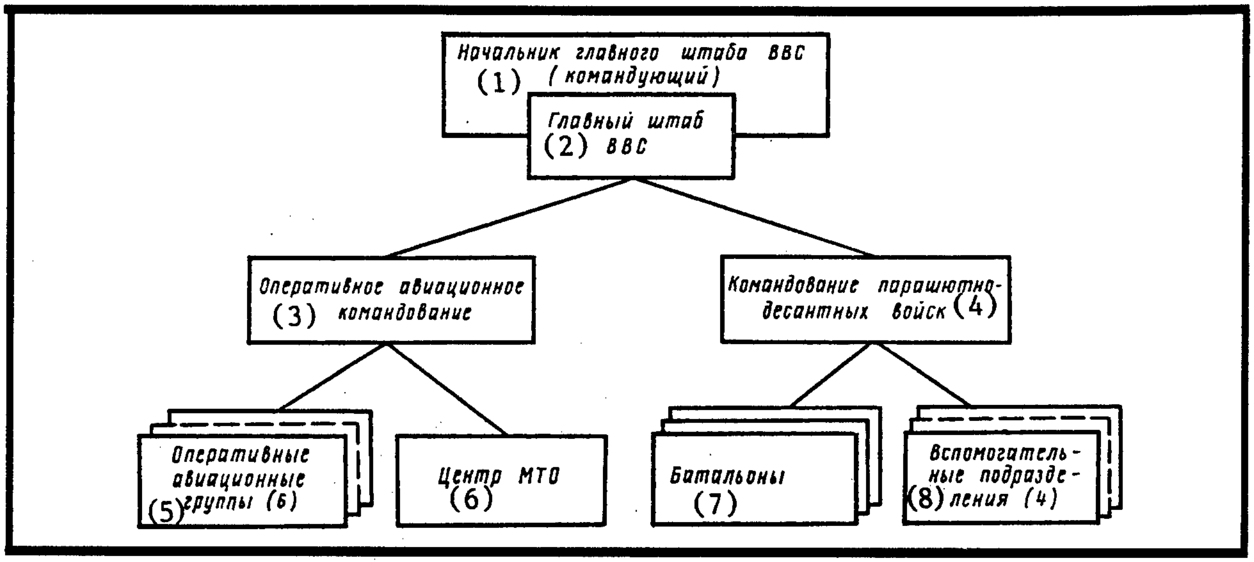


Figure 1. Basic Organization of the Portuguese Air Force

Key:
1. Air force chief of main staff (commander)
2. Air force main staff
3. Operational air command
4. Paratroop command
5. Operational air groups (6)
6. Materiel support center
7. Battalions
8. Auxiliary subunits (4)

personnel and military cargo in the interests of all armed services, organizing search and rescue of the crews of airplanes, helicopters and ships in distress, and protecting contiguous marine bodies of water. In peacetime the Portuguese Air Force additionally carries out a number of functions atypical of military aviation, conducts reconnaissance of natural resources, protects the fishing zone and so on.

Considering the unique geographic position of Portugal, the NATO leadership plans to use the country's air force to fight enemy submarines and surface ships in coastal regions of the Atlantic Ocean, and to monitor and provide air defense to a segment of the principal "air bridge" between the USA and the Near East—from the Azores to the continental part of the country. The air force is given a special role in providing cover to Lagens Air Force Base on these islands, used by the American Air Force during strategic transfers of troops and tactical aviation to the European continent and the Near East.

The Portuguese Air Force is headed by the air force chief of main staff (commander). He is subordinated directly to the country's defense minister, he is responsible for the day-to-day activities and combat readiness of the air force, and he exercises leadership over the units and subunits by way of the main staff of the air force (located in Alfadzhid [transliteration]). Organizationally the resources of the air force are grouped together into an operational air command and a paratroop command. The former includes operational air groups, a materiel support center and radiotechnical subunits responsible for airspace surveillance and air traffic control. The organization of the Portuguese Air Force is shown roughly in Figure 1.

The operational air group[1] is the principal air unit of the Portuguese Air Force. Its composition includes from two to five air squadrons. The group commander is responsible for combat training, materiel support and personnel acquisition in subunits subordinated to him. Presently the Portuguese Air Force has six such air groups, stationed at six principal air bases: the 12th (air base No 1, Sintra), the 21st (No 2, Outao), the 31st (No 3, Tankush [transliteration]), the 41st (No 4, Lagens, Azores), the 51st (No 5, Monte Real) and the 61st (No 6, Montijo).

According to the foreign press the Portuguese Air Force adopted a clear system of numbering air squadrons depending on their basic purpose. For example the numbers of all training and combat training squadrons begin after 100 (101st, 102d etc.), fighter (air defense) squadrons are numbers above 200, fighter-bomber squadrons are numbers above 300, reconnaissance squadrons are numbers above 400, airlift squadrons are above 500, transport helicopter squadrons are above 550, shore-based patrol squadrons are above 600, observation, target indication and communication squadrons are above 700, and search and rescue squadrons are above 750.

The Portuguese Air Force permanently maintains 19 air squadrons containing more than 300 aircraft, of which around 100 are warplanes and over 60 are various types of helicopters (the composition of the air force is shown in greater detail in the table). The personnel strength attains 12,600 (including 2,170 airborne troops).

The materiel support center is in Alberca di Rivatizhu [transliteration] (10 km north of Lisbon). It includes two departments—aviation equipment repair, and materiel supply. The former consists chiefly of main repair shops employing over 3,000 persons. They do complex forms of maintenance and repair (including overhaul) of aviation equipment. Besides repairing their own airplanes and helicopters, these shops repair American F-4, A-6, P-3, C-2 and C-130 airplanes belonging to American air force and naval air units and subunits in Western Europe and in the Mediterranean Sea area, on the basis of a contract signed with the American Defense Department.

Spare parts, units and outfits of onboard equipment necessary for the repair of broken-down aviation equipment are concentrated in the main materiel support depot, located in the same place. This depot supplies units and subunits with material, technical resources, and other resources and objects.

The country's air defense system consists of air force radiotechnical subunits manning a control and warning

Effective Combat Strength and Stations of Units and Subunits of the Portuguese Air Force

Air Base		Units and Subunits		Airplanes and Helicopters	
Number	Name	Air Group Number	Squadron Number (Purpose)	Number	Type, Name
1	Sintra	12	401 (reconnaissance)	4	C.212 Aviocar
			102 (training)	25	T-37C
2	Outao	21	701 (communications)	16	FTB-337G
			702 (communications)	16	FTB-337G
			101 (training)	around 30	DHC-1 Chipmunk
3	Tankush	31	502 (transport)	11	C.212 Aviocar
			552 (helicopter)	25	Alouette-3
			111 (training)	7	1 C.212 Aviocar 6 Alouette-3
4	Lagens (Azores)	41	303 (fighter)	25	22 G-91R.4 and 3 G.91T.3
			503 (transport)	6	C.212 Aviocar
			752 (helicopter)	5	SA.330 Puma
5	Monte Real	51	302 (fighter-bomber)	23	20 A-7P and 3 TA-7P
			304 (fighter-bomber)	23	20 A-7P and 3 TA-7P
			103 (combat training)	27	15 T-33A and 12 T-38A
6	Montijo	61	301 (fighter-bomber)	32	25 G-91R.3 and 7 G-91T.3
			501 (transport)	5	C-130 Hercules
			504 (transport)	3	Falcon-20
			551 (helicopter)	27	Alouette-3
			751 (helicopter)	7	SA.330 Puma

center and four radar posts. The control and warning center is located in Monsanto (a suburb of Lisbon), while the radar posts are located on high ground: in particular on Mount Monsanto (serviced by the 10th Radar Squadron), Monte Zhuntu [transliteration] (near Outao Air Base, the 11th), Pacos de Ferreira (25 km north of Porto, the 12th) and San Roman (Estrela Mountains, the 13th).

These radar resources are the backbone of the system for airspace surveillance and for guiding fighters to airborne targets. They coordinate closely with air traffic control organs of civil aviation, as well as with Spain's Combat Grande automated air defense control system, which has access to NATO's NADGE automated air defense resource control system.

The paratroops, which were created in 1951, were widely employed in punitive operations against forces of the national liberation movement in former Portuguese colonies—for example in Angola and Mozambique. Their subunits are now under the paratroop command (headquartered in Monsanto), which is directly subordinated to the air force chief of main staff. It includes three operational bases (Monsanto, Aveiro and Beja) and one training base (Tankush). The paratroop command's effectives include three paratroop battalions, an antitank company, an assault landing support group, a training battalion and a materiel support battalion.

The principal fighting unit of the paratroops is the paratroop battalion, which contains around 500 men. It includes three paratroop companies and an administration and service company. According to reports in the foreign press the paratroops are intended for assault landing operations both independently and in coordination with ground troops and marine infantry, and for support of anti-assault defense of important military installations, protection of government institutions and fulfillment of search and rescue operations.

In regard to the basing question, the Western press reports that besides the air bases mentioned above, which are the permanent stations of the air units and subunits, the country possesses reserve bases and airfields intended for dispersal of aviation and maneuver of its resources. They include the air bases at San Jacinto, Ovar and Beja, as well as 12 other airfields (some of them are presently being used by civil aviation).

According to the foreign press Portuguese air bases are included in NATO's infrastructure even in peacetime. Special attention is devoted to the air base at Lagens and to other installations on the Azores. Emphasizing the important significance of these islands, America's General L. Wright declared: "As long as we hold the Azores, we will control the Atlantic."

In the plans of the USA and NATO, Lagens is seen as a base for the struggle against enemy submarines, and as the main transloading point supporting transfer of troops and cargo from the USA to the Mediterranean region and the Near East. Confirming this fact, the Western press reports that up to 250 airplanes use this base each month as an intermediate airfield in flights from the USA to the regions mentioned above. Besides air subunits of the Portuguese Air Force, five American P-3 Orion shore-based patrol airplanes serve constant combat duty and EC-135 airborne command posts of the U.S. Air Force periodically land at Lagens Air Base.

Over 1,050 persons of the Portuguese Air Force (820 servicemen and 233 civilian specialists) and 1,800 American servicemen (air force—1,300, navy—450, ground troops—50) are stationed permanently at Lagens Air Base and other installations on the Azores in order to support their activities. Recently the USA allocated $100 million to improve operational equipment on the islands.

The combat training center of the West German Air Force is located at Beja Air Base in compliance with a bilateral government agreement between the FRG and Portugal. It consists of a squadron of Alpha Jet light attack aircraft (16 airplanes) of the 44th Regular Fighter-Bomber Squadron of the West German Air Force.

Personnel Training

Personnel training (flight and engineering-technical) is provided to the air forces mainly by the air force academy located at Sintra Air Base. The term of training is 4-5 years. The academy's material and equipment base (besides laboratories and special classes, it possesses models of practically all airplanes and helicopters operating in the country's air force) makes it possible to train engineers and technicians of sufficiently high qualifications.

The flight personnel study theoretical disciplines at the academy, and they learn to fly in training and combat training air squadrons. In particular students undergoing initial flight training fly DHC-1 Chipmunk light piston-engine airplanes in the 101st Air Squadron at Outao Air Base (Figure 2). They come here in groups of up to 25 and fly for 4-5 months. In the first phase of the training (18-20 flying hours) the instructors determine whether the students are suited to flying. Students who wash out return to the academy, where the question of allowing them to continue their service as ground air specialists is resolved. In the second phase the students continue mastering the techniques of piloting the Chipmunk (the total average flying time clocked by each student is 60 hours).

The basic flight training course is organized for students at Sintra Air Base in the 102d Air Squadron using T-37C airplanes (see Figure 2). Here they practice piloting techniques (visual and instrument piloting) and the principles of combat use. Students who successfully complete this training phase and are assigned to fighter aviation are sent to Monte Real, where they take an advanced flight training course aboard T- 33A (Figure 3)

and T-38A jets of the 103d Combat Training Squadron. Their training includes formation flying, flying in adverse weather day and night, combat use and so on.

Students training for multi-seater airplanes and helicopters are sent to the 11th Training Air Squadron (Tankush Air Base). Here they learn to fly the C.212 Aviocar airplane or the Alouette-3 helicopter.

After finishing their training at the academy, the students perfect their flying skills in operational air units.

Combat Training

Portuguese pilots undergo combat training in the course of day-to-day training, and their skills are tested in various exercises and competitions conducted according to the plans of the command of the country's armed forces and the military leadership of the NATO bloc.

The combat aircraft fleet of the Portuguese Air Force consists chiefly of obsolete subsonic A-7P Corsair-2 attack airplanes retired from the U.S. Navy (see color insert [not reproduced]) and West German G-91 fighter-bombers of various modifications (R.3, R.4 and T.3). Because the air force does not possess air defense fighters and reconnaissance airplanes, fighter-bomber crews from the 301st and 303d air squadrons regularly fly air reconnaissance, intercept and aerial combat missions, in addition to attacking ground and marine targets in behalf of the ground troops and the navy. The same missions are assigned to the 302d and 304th air squadrons, equipped with A-7P attack aircraft.

Besides conveying troops and cargo and dropping airborne troops, subunits equipped with C-130 Hercules and C.212 Aviocar military transport airplanes (the 501st, 502d and 503d air squadrons) fly patrols over the sea, they fly weather reconnaissance and electronic warfare missions, and they participate in search and rescue operations. Besides carrying out their principal mission, helicopter transport squadrons (the 551st and 552d, Alouette-3 helicopters) train for direct air support to ground troops, for which purpose 12.7-mm machineguns and launchers for air-launched free rockets (Figure 4) are installed aboard the helicopters, and for evacuation and rescue operations. Alouette-3 helicopters from the transport subunits mentioned above regularly patrol the country's coastal regions jointly with Puma helicopters from the 751st and 752d search and rescue air squadrons (Figure 5).

As was mentioned above, in peacetime the Portuguese Air Force takes part in exploring natural resources, spotting fish schools, protecting fishing regions, providing assistance to the population in the event of natural disasters and so on. In particular, the first three missions are assigned to crews of the 401st Reconnaissance Air Squadron, which is equipped with four C.212 Aviocar transport airplanes. In this case two of the airplanes are equipped with aerial cameras, a third carries special infrared apparatus, and a fourth carries magnetometers and spectrometers.

Besides their main mission, the communications squadrons (701st and 702d, FTB-337G airplanes, see color insert [not reproduced]) train in airlifting tactical assault forces, in conducting air reconnaissance (the airplanes are equipped with aerial cameras and other reconnaissance apparatus for this purpose) and in providing direct air support to ground troops and airborne forces (the FTB-337G can accommodate 12.7-mm machinegun or 20-mm aircraft cannon mounts, launchers for 70-mm caliber free rockets and bombs on pylons). Part of the crews of these subunits train as airborne command post operators, carrying out functions such as guiding attack aircraft to airborne and ground targets and correcting artillery fire. Thus airplanes of the 702d Air Squadron are regularly used as airborne command posts when the crews of attack airplanes and helicopters practice bombing and fire missions over the firing range.

The training and combat training air squadrons (101st, 102d, 103d and 111th) concern themselves chiefly with personnel training. The foreign press notes, however, that if necessary, their crews (and especially those from the combat training squadrons) could be assigned other missions. For example instructor pilots and the best-trained students undergoing training in the 103d Combat Training Air Squadron (T-38A airplanes) regularly practice airborne target interception and mobile aerial combat, preparing for a role in air defense fighters. The Western press emphasizes that the permanent staff of other training subunits can also be used for air reconnaissance, for strikes against ground targets and so on.

Besides participating in daily combat training in accordance with the plan of their command, the air subunits of the Portuguese Air Force take part in various exercises organized for the combined armed forces of NATO. Thus A-7P attack aircraft crews of the 304th Air Squadron participated in exercises of the bloc's combined air forces conducted at Ever [transliteration] Air Base (FRG). G-91 airplanes regularly participate in NATO Tiger Mitt exercises, they practice joint operations with Italian air subunits in northern Italy, and so on.

Development of the Portuguese Air Force

Development of the Portuguese Air Force is being accomplished through purchases of aviation equipment from the USA and other countries, through modernization of the existing airplane fleet and through improvement of the combat training of air units and subunits. Thus deliveries of consignments of A-7P attack aircraft, Maverick guided missiles and other modern weapons and equipment from the USA have been completed.

After obsolete Neptune shore-based patrol airplanes were retired in 1984, the command of the Portuguese Air Force was compelled to transfer the antisubmarine warfare function to subunits equipped with military transport airplanes and helicopters not adapted for this purpose. This is why a decision was made to acquire six P-3B Orion airplanes from Australia; after appropriate modernization they will be transferred to the Portuguese Air Force this year. These airplanes are to make up the 601st ASW Air Squadron.

In order to improve the capabilities of the air defense system, the missions of which are presently carried out by the 301st and 303d fighter-bomber air squadrons, which are equipped with G-91 fighter- bombers, there are plans to acquire a consignment of American F-16A fighters. Eighteen Epsilon airplanes were ordered from France as replacements for the obsolete Chipmunk trainers. In addition another three C-130E military transport airplanes were acquired from the USA, and 12 A-109 helicopters were acquired from Italy, including four with TOW antitank rockets.

The plans for improving aviation equipment presently in the inventory foresee the following measures:

—purchasing suspended pods containing forward-looking infrared apparatus, and a heads-up information display system, and installing them in A-7P airplanes;

—equipping G-91 fighter-bombers with inertial navigation systems and fitting them out with guided bombs with a laser homing system;

—modernizing T-33 and T-37 airplanes (with the assistance of America's Boeing corporation).

Implementation of these and other measures while concurrently improving the personnel combat training system will make it possible for the command of the Portuguese Air Force, in the opinion of Western experts, to significantly widen the capabilities of the air units and subunits associated with the combat missions posed to them by the military leadership of the country and the NATO bloc.

Footnote

1. Operational air groups of the Portuguese Air Force are often referred to in the Western press as air wings.—Editor

Foreign Helicopter Engines

18010461f Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 43-48

[Article by Col Yu. Alekseyev, Cand Tech Sci]

[Text] The propulsion unit is said to be one of the principal components of all types of aircraft, including helicopters. The latter are equipped chiefly with turboshaft engines, which are a modification of gas turbine engines. Turboshaft engines are unique in that excess power from the turbocompressor is transmitted to the output shaft, and as a rule the engine itself does not possess a reduction gear box, with the exception of some designs developed in France and Great Britain.

Use of turboshaft engines in the propulsion units of military helicopters began in the first half of the 1950s. This provided for a quantitative leap in characteristics such as the power-to-weight and power-to-volume ratios of propulsion units in comparison with piston engines. The first gas turbine helicopters were distinguished by high fuel consumption and significant reduction of power with increasing altitude. However, these shortcomings were altitudes and over short distances.

The experience of using gas turbine helicopters in the course of the USA's aggressive war in Vietnam made it possible to reveal some problems and the trends in development of turboshaft engines, which are still important today. They reduce to satisfying the following requirements:

—a long service life in so-called rigorous conditions, particularly the capability for operating stably in conditions close to those of maximum power, for a long time and at low altitude, in the presence of rain and snow;

—protection from bullets and shell fragments, which is especially important to the engines of helicopter gunships;

—simplicity of operation in the troops, not requiring highly skilled technical personnel; helicopters, ensuring their survival in the event that one of the engines fails. The power of such a propulsion unit should be practically twice greater than that of a single-engine system, while the weight of the helicopter remains the same. This imposes additional problems on the designers concerned with reducing weight and cost and improving the operating characteristics of the engines per unit of sustained power. In addition the problem of ensuring low specific fuel consumption acquires special significance because in usual cruising flight, each of the engines works at a power output somewhat exceeding 50 percent of maximum. This is good from the standpoint of engine life, but it is far distant from the optimum conditions of specific fuel consumption.

Basic Characteristics of Foreign Turboshaft Engines

(1) Обозначение двигателя, страна-разработчица	(2) Мощность на максимальном режиме, л. с. / удельный расход топлива на максимальном режиме, кг/л. с. · ч (3)	(4) Расход воздуха, кг/с / степень повышения давления (5)	(6) Температура газов перед турбиной, °С	(7) Масса, кг / длина × диаметр, м (8)	(9) На каких вертолетах устанавливается
1	2	3	4	5	6
T800-LHT-800, США (10)	1230 / 0,208	• / •	•	135 / 0,86 × 0,51	Разрабатывается для LHX (11)
T800-APW-800, США	1200 / 0,21	• / 15	•	135 / 0,98 × 0,47	То же (12)
T701-AD-700, США	8080 / 0,213	20,1 / 12,8	•	535 / 1,88 × 0,94	Разрабатывается для HLH (13)
T702-LD-700, США	815 / 0,258	2,03 / 8,5	•	110 / 0,79 × 0,57	HH-65A
T703-A-700, США	650 / 0,268	2,54 / 8,6	725 [1]	110 / 1,1 × 0,64	OH-58D
T700-GE-700, США	1620 / 0,21	4,5 / 15	1240	200 / 1,17 × 0,64	UH-60A
T700-GE-701, США	1700 / 0,21	4,5 / 15	1270	200 / 1,17 × 0,64	AH-64A
T700-GE-701A, США	1715 / 0,21	• / •	•	200 / 1,17 × 0,64	S-70C
T700-GE-701C, США	1850 / 0,204	• / •	•	200 / 1,17 × 0,64	В стадии разработки (14)
T700-GE-401, США	1690 / 0,21	4,5 / 15	1270 (827 [1])	195 / 1,17 × 0,64	HH-60D
T700-GE-401A, США	1700 / 0,213	• / •	•	205 / 1,17 × 0,64	Предполагается использовать на опытных образцах EH-101 (15)
T700-GE-401C, США	1850 / 0,204	• / 17,1	1370	200 / 1,17 × 0,64	В стадии разработки (14)
T400-WV-402, США [2]	1970 / 0,268	• / 7,7	•	350 / 1,7 × 1,12	AH-1J и T (16)
T400-CP-400 и 401, США [2]	1800 / 0,27	• / 7,4	•	325 / 1,7 × 1,12	AH-1J, UH-1N, VH-1N
T64-GE-419, США	4750 / 0,213	• / 14,9	•	330 / 2 × 0,51	CH-53E, MH-53E
T64-GE-415 и 416, США	4380 / 0,213	• / 14,8	1100	330 / 2 × 0,51	CH-53D и E, RH-53D и E
T64-GE-100, США	4330 / 0,218	• / 14,9	•	330 / 2 × 0,51	S-65C
T64-GE-7A, США	3940 / 0,213	12,8 / 14,1	•	330 / 2 × 0,51	CH-53C, HH-53C
T63-A-720, США	420 / 0,295	1,56 / 7,3	810 [1]	70 / 1,05 × 0,59	OH-58C
T58-GE-16, США	1870 / 0,24	• / 8,6	•	200 / 1,62 × 0,61	CH-46E
T58-GE-10, США	1400 / 0,272	• / 8,4	•	160 / 1,5 × 0,53	CH-46D, UH-46D и F, SH-3D

Basic Characteristics of Foreign Turboshaft Engines (cont'd)

1	2	3	4	5	6
T58-GE-8F, США (17)	1350 / 0,272	• / 8,2	•	140 / 1,5 × 0,53	CH-46A, SH-3G, SH-2F
T58-GE-5, 100 и 402, США	1500 / 0,272	• / 8,4	•	130 / 1,5 × 0,53	(18) SH-3E и F, HH-3E и F
T55-L-712, США	3750 / 0,235	• / 8,2	•	340 / 1,19 × 0,61	CH-47D
T55-L-11A, D и E, США	3750 / 0,24	12,25 / 8,2	•	305 / 1,12 × 0,62	CH-47C
T53-L-703, США	1550 / 0,272	• / 8	•	250 / 1,21 × 0,58	AH-1Q и S
T53-L-13B, США	1400 / 0,262	5.53 / 7,4	•	245 / 1,21 × 0,5[illegible]	UH-1H
250-C20F и J, США	420 / 0,295	1,54 / 7,2	810 [1]	70 / 0,98 × 0,51	(19) Хьюз 500D и E
250-C30L, M и P, США	650 / 0,268	2,54 / 8,6	740 [1]	110 / 1,04 × 0,64	S-76A, Хьюз 530
250-C30S, США	700 / 0,268	2,54 / 8,6	740 [1]	110 / 1,04 × 0,64	A-109, S-76 Mk2
250-C34, США	770 / 0,268	2,54 / 8,5	800 [1]	120 / 1,1 × 0,64	В стадии разработки (20)
GEM-2 Мк1001, Великобритания (21)	900 [3] / 0,235 [3]	• / 12	•	150 / 1,08 × 0,6	WG-13
GEM-2 Мк1004, Великобритания	1035 [3] / 0,24 [3]	• / 11,5	•	140 / 1,08 × 0,6	A-129
GEM-41-1 Мк1014, Великобритания	1120 [3] / 0,22 [3]	• / 12,7	•	155 / 1,08 × 0,S	WG-13, WG-30
(22) «Гном-Н1400-1», Великобритания	1660 / 0,275	6,26 / 8,5	•	150 / 1,4 × 0,58	«Коммандо» (23)
«Гном-Н1400», Великобритания	1500 / 0,275	6.26 / 8,4	•	150 / 1,4 × 0,58	«Си Кинг» (24)
«Нимбус (25) Мк1051502», Великобритания	710 / 0,38	• / 6	•	305 / 1,85 × 0,89	«Скаут» (26)
«Нимбус Мк1031503», Великобритания	710 / 0,38	• / 6	•	295 / 1,85 × 0,89	«Уосп» (27)
T64-MTU-7, ФРГ [4] (28)	3925 / 0,218	• / 13	•	320 / 1,48 × 0,51	CH-53G
T53-L-13, ФРГ [4]	1400 / 0,262	5 53 / 7,4	•	245 / 1,21 × 0,59	UH-1D
250-MTU-C20B, ФРГ [4]	420 / 0,295	1,54 / 7,2	810 [1]	70 / 0,98 × 0,51	BO-105M и P
RTM-322-01 Великобритания, Франция (29)	2100 / 0,2	• / 14,7	1200	240 / 1,17 × 0,65	В стадии разработки. (30) Предполагается устанавливать на вертолетах NH-90 и EH-101
MTM385R, ФРГ, Франция (31)	1400 / 0,216	3,4 / 11,2	1150	190 / 1,3 × 0,7	Разрабатывается для (32) перспективных боевых вертолетов PAH-2 и HAC-3G
TM333-1M, Франция (33)	910 [3] / 0,235 [4]	• / 11	1100	135 / 0,94 × 0,56	Разрабатывается для (34) SA-365M

Basic Characteristics of Foreign Turboshaft Engines (cont'd)

1	2	3	4	5	6
ТМ319, Франция (35)	510[3] / 0,25[3]	• / •	•	85 / 0,81 × 0,52	AS-355, AS-350
(36) «Макила-1А», Франция	1910 / 0,215	• / •	•	240 / 2 × 0,57	SA-332
(37) «Турмо-3С7», Франция	1610 / 0,29	5,9 / 5,9	•	325 / 1,95 × 0,72	SA-321
«Турмо-4С», Франция	1560 / 0,29	• / 5,9	•	• / 2,18 × 0,72	SA-330
«Ариэль», (38) Франция	730[3] / 0,25[3]	• / 8	•	110 / 1,2 × 0,63	SA-365, AS-350
(39) «Артуст-3В», Франция	560 / 0,3	• / 5,4	•	180 / 1,8 × 0,67	SA-315, SA-316
(40) «Астазу-2А», Франция	520 / 0,282	• / •	•	• / 1,27 ×0,48	SA-318C
«Астазу-3», Франция	590 / 0,29	2,5 / 5,7	•	145 / 1,4 × 0,46	SA-341
«Астазу-14В и F», Франция	590 / 0,282	• / •	•	165 / 1,43 × •	SA-319B
«Астазу-14Н», Франция	590 / 0,255	• / 7,5	•	160 / 1,47 × 0,56	SA-342
«Астазу-18А», Франция	870 / 0,245	• / •	•	155 / 1,33 × 0,7	SA-360
Т58-GE-3, Италия (41)	1325 / 0,272	• / 8,2	•	140 / 1,5 × 0,53	AB-204B
Т55-К-712, Япония[4] (42)	3750 / 0,235	• / 8,2	•	340 / 1,19 × 0,61	CH-47-414
Т53-К-703, Япония[4]	1485 / 0,272	• / 8	•	250 / 1,21 × 0,59	AH-1S
Т53-К-13В, Япония[4]	1400 / 0,262	5,53 / 7,4	•	245 / 1,21 × 0,59	UH-1H

(43) [1] Температура газов перед силовой турбиной.
(44) [2] Разработан канадским отделением американской фирмы «Пратт энд Уитни».
(45) [3] Чрезвычайный режим.
(46) [4] Производство по американской лицензии.

Key:
1. Engine designation, developing country
2. Maximum output, horsepower
3. Specific fuel consumption at maximum output, kg/hp·hr
4. Air consumption, kg/sec
5. Pressure ratio
6. Gas temperature before turbine, °C
7. Weight, kg
8. Length x diameter, m
9. Helicopters in which installed Maximum output, horsepower
3. Specific fuel consumption at maximum output, kg/hp·hr
4. Air consumption, kg/sec
5. Pressure
10. USA
11. Under development for the LHX
12. As above
13. Under development for the HLH
14. In the development stage
15. Planned for use in experimental models of the EH-101
16. And
17. USA
18. And
19. Hughes
20. In development stage
21. Great Britain
22. Gnome
23. Commando
24. Sea King
25. Nimbus
26. Scout
27. Wasp
28. FRG
29. Great Britain, France
30. In development stage. Planned for installation in NH-future PAH-2 and HAC-3G helicopter gunships
33. France
34. Under development for the SA-365M
35. France
36. Makila [transliteration]
37. Turmo
38. Ariel
39. Artouste
40. Astazou
41. Italy
42. Japan
43. Gas temperature before power turbine
44. Developed by the Canadian division of America's Pratt and Whitney
45. Extreme conditions
46. Produced by American license

In the mid-1980s, firms in the USA, France and Great Britain were the principal developers and producers of turboshaft engines in capitalist countries. Specialists of American firms designed engines with horsepowers from 420 to 4,380, while European firms designed engines with horsepowers from 500 to 1,900. In addition production of turboshaft engines was initiated in the FRG, Italy and Japan on the basis of licenses, chiefly American. Their output is 420-3,925 horsepower. Turboshaft engines are being produced in Canada at enterprises of the Canadian affiliate of America's Pratt and Whitney.

Structurally, turboshaft engines consist of the following basic components—compressor, combustion chamber, compressor drive turbine and power turbine. Compressors of all types are employed—axial, centrifugal and combined. Axial centrifugal. As a rule the combustion chambers are ring-shaped, while in the most modern engines they are the through-type. Power turbines of modern engines (one- and two-stage) that transmit power to the output shaft are free turbines—that is, they are not mechanically linked to the compressor drive turbines.

Judging from reports in the foreign press, turboshaft engines have a gas temperature before the compressor drive turbine up to 1,270° C (it is 800° C and more before the power turbine), the rotor rpm is 19,500-44,700, and the rpm of the output shafts is from 6,000 to 21,000.

The operating conditions of turboshaft engines on helicopters to a certain extent predetermined their standard operating modes (in regard to power). Although the approach to this question differs in different countries, in most cases the standard operating modes are defined as maximum or take-off (usually about 5 minutes in duration), maximum sustained (unlimited operating time) and cruising (75 percent of maximum power). There is also an intermediate mode (between maximum and maximum sustained, of which the 30-minute mode is one variant), while multiple- engine propulsion units are capable of several extreme modes determining the maximum time of operation with one engine (as a rule, from several dozen seconds to 2.5 min). The specific operating modes of each engine are determined by the corresponding manuals.

Today, many capitalist countries are designing new turboshaft engines for helicopters; the largest projects are being conducted by companies in the USA, Great Britain, France and the FRG.

Thus the USA is improving the T700 engine (installed aboard UH-60A Black Hawk and AH-64 Apache helicopters) and developing engines of a new generation—the T800 in the 1,200 horsepower class (for a light helicopter in the LHX program) and the T701 in the 8,000 horsepower class (for a heavy helicopter in the HLH program). Moreover the cost and operating requirements of engines presently under development are being raised to the level of the requirements on helicopter combat characteristics. This conception is typical in particular of the T800 engine, in relation to which requirements of equal importance are imposed on

cost, on the level of the technology utilized and on operating qualities, which are sometimes combined under the general concept "operational and technological quality." This concept foresees ensuring dependability of start-up and operation during flight, and simplicity of technical operation and maintenance. American specialists view the new generation of turboshaft engines generally as sets of spare parts that should be easily replaced during operation of helicopters under troop conditions.

Scientific research programs being conducted in the USA foresee significantly raising the operating parameters of turboshaft engines by the year 2000, to include increasing the pressure ratio from 7-15 to 20-25 and the gas temperature before the turbine from 1,270 to 1,760-1,930° C. The pressure ratio of the T700-GE-401C 1,850 horsepower engine presently under development is already more than 17, and the gas temperature before the turbine is 1,370°.

The problem of significantly increasing gas temperature before the turbine is to be solved by utilizing promising structural materials and improving turbine cooling systems. It is hoped that the procedures for manufacturing turbine nozzles out of ceramics, turbine blade shrouds out of composite materials and shafts out of composite materials with a metallic matrix may become practical by 1995. The procedures of manufacturing various engine parts working at high temperatures out of reinforced ceramics and carbon-carbon composite materials may become practical by the year 2000. The procedures of manufacturing blades with small cooling air channels are believed to be one of the problems of raising the effectiveness of turbine cooling systems.

Much attention is being devoted in the creation of turboshaft engines of the new generation to developing digital electronic control systems for them. Today's engines mainly use hydromechanical control systems which sometimes contain auxiliary electronic devices. Most developers feel that military turboshaft engines of the future must have so-called full- fledged digital electronic control systems—that is, ones which would not only ensure maintenance of the given engine operating mode but also become an inherent part of the helicopter and weapon onboard integral control system. In regard to the engine, they will permit control of more than a dozen parameters, maintenance of optimum operating modes in correspondence with the flying conditions, and dependable engine operation in modes close to the operating limits.

Fiber-optics for data transmission lines, turbine blade temperature measuring units, electronic torque measuring units and control algorithms are being developed for full-fledged digital electronic control systems. Such control systems are already finding uses in a number of new engine models. It is believed that their potentials may be fully realized by the mid-1990s.

In order to retain a position in the world helicopter market in the face of American competition, European NATO countries are combining their efforts to design helicopter engines of a new generation. Thus in 1985 Motoren und Turbinen Union (FRG), Turbomeca (France) and Rolls-Royce (Great Britain) signed an agreement to cooperate in the development of engines in three power classes (minimal), in accordance with which Turbomeca is working on the TM333 engine (850 horsepower), Motoren und Turbinen Union and Turbomeca are working on the MTM385 (1,200 horsepower), and Rolls Royce and Turbomeca are working on the RTM322 (2,100 horsepower). In addition the agreement foresees a possibility for developing other engines in the 800-3,200 horsepower class.

The principal characteristics of foreign turboshaft helicopter engines, compiled from materials in the foreign press, are presented in the table.

(To be concluded)

Training Fighter Pilots for the Canadian Air Force

18010461g Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) p 48

[Article by Col A. Osipov]

[Text] Much attention is devoted in the training and combat training of air units and subunits of the Canadian Air Force to teaching air defense fighter pilots the techniques of intercepting airborne targets and aerial combat, and of other forms of combat activities in northern conditions.

Such training (it includes basic and advanced) is conducted at Cold Lake Air Base, which is where young pilots go after completing their training in Pilot School No 2 (Moose Jaw, Saskatchewan), while experienced pilots go there from operating units to cross-train to the CF-18. First they take a basic fighter training course in the 419th Combat Training Air Squadron aboard CF-5 airplanes, and then they move to the 410th Combat Training Air Squadron, which is equipped with 17 two-seater and 10 one-seater CF-18s. Each year 52 pilots undergo training in the 410th Combat Training Air Squadron (26 in each half-year period). The training time is 5.5 months. The advanced training program foresees 161 hours of ground training and 71.5 hours of flight training.

The ground training course includes study of the following subjects: Instruction in the CF-18—69 hours (including independent study), the APG-65 onboard radar station—14 hours, aircraft armament—10 hours,

tactics of airborne target interception—12 hours, tactics of aerial combat—10 hours, electronic warfare—15 hours, instruction in combat use of weapons—31 hours.

During study of the last subject the main attention is devoted to practical problems such as control and unusual situations (three exercises, to which 3.75 hours are allocated), interception (nine exercises, 9 hours), the basic forms of maneuvers employed by the fighter (three exercises, 2.25 hours), maneuvering in aerial combat (four exercises, 3 hours), and actions in response to the use of electronic warfare resources (three exercises, 3 hours).

Flight training is conducted over 78 flying days. The flying time accumulated in this period by the students averages 43.8 hours with an instructor and 27.7 hours solo. Most flights are conducted during the day, and 7.5 hours are reserved for flying in the conditions of the Arctic winter.

The Turkish Navy

18010461h Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 49-56

[Article by Capt 1st Rank V. Burlyayev]

[Text] Viewing NATO membership as "a guarantee of national security," the military-political leadership of Turkey actively favors escalation of the North Atlantic alliance's military power, and it is developing its armed forces, including the navy, in full correspondence with its interests.

The NATO command takes heed of Turkey's important strategic position in its planning of the operations of a future war. Foreign specialists feel that the Sea of Marmara, the straits of Bosporus and Dardanelles, which connect the Black and Mediterranean seas, and the regions contiguous with them are a key position in the Southern European theater of military operations. In their opinion control of the Black Sea strait zone would hinder exit of Soviet ships and vessels from the Black Sea into the Mediterranean, while at the same time ensuring passage of the warships of NATO's combined naval forces for actions directly against the Soviet Union. These circumstances were at the basis of the conception of using the Turkish navy in a future war, according to which its main purpose would be to support favorable operating conditions in this region, so important to NATO, in coordination with the navies of other states in the bloc.

It is reported in the foreign press that the Turkish navy will carry out the following basic missions in wartime: blockading the Black Sea straits, fighting the enemy's naval forces and interdicting his marine lines of communication in the Black Sea and the northeastern Mediterranean, assisting ground troops in maritime sectors, protecting friendly lines of communication, defending the country's shores from mines and assault landings, participating in marine assault landing operations, and conducting reconnaissance in behalf of national armed forces and NATO's combined armed forces.

The Turkish command plans to carry these missions out in stages (zone by zone). Submarines and the air force are to be used primarily in the first stage (in the far zone). These forces are to fight squadrons of the enemy's assault landing ships at the places of their formation and as they travel over the sea. In the second stage (in the middle zone) destroyers, frigates, minelayers and groups of missile and torpedo boats will participate in the combat activities in coordination with shore- based patrol and fighter-bomber aviation. The mission of these forces would be to destroy the enemy's resources at the approaches to the strait zone and the country's shores, and to prevent the landing of marine assault forces. Fighter-bombers, destroyers, frigates and the fleet's light forces would attack ships and transporters, minelayers would lay minefields on the approach routes of assault landing forces to assaultable segments of the coastline, and antisubmarine aviation would hunt and kill submarines. The enemy's assault landing forces are to be destroyed in the third stage (in the near zone) with the goal of breaking off his penetration into Turkish territory. There are plans for using specially allocated ground troop units and formations, coastal rocket artillery units, stationary and mobile coastal defense subunits and remote-controlled minefields.

The general principles of the development of the Turkish navy, of its combat use and of operational and combat training are being developed under the observation of American military advisors and with their participation. The plans for development of the navy foresee increasing its combat capabilities by adopting newer ships and airplanes and by modernizing existing ones. The main suppliers of weapons and military equipment to the Turkish navy are the USA and the FRG, which also provide technical assistance to the navy in expanding its own ship- building and in providing personnel training.

In peacetime, the Turkish navy is under national subordination, while with the breakout of war and during exercises and maneuvers, control of the navy is transferred to the command of NATO's combined naval forces in the Southern European theater of military operations.

Organization

The Turkish navy is an independent armed force. It is headed by a commander who provides administrative and operational leadership to the naval forces by way of a staff located in Ankara. The organizational structure of the Turkish navy foresees creation of homogeneous

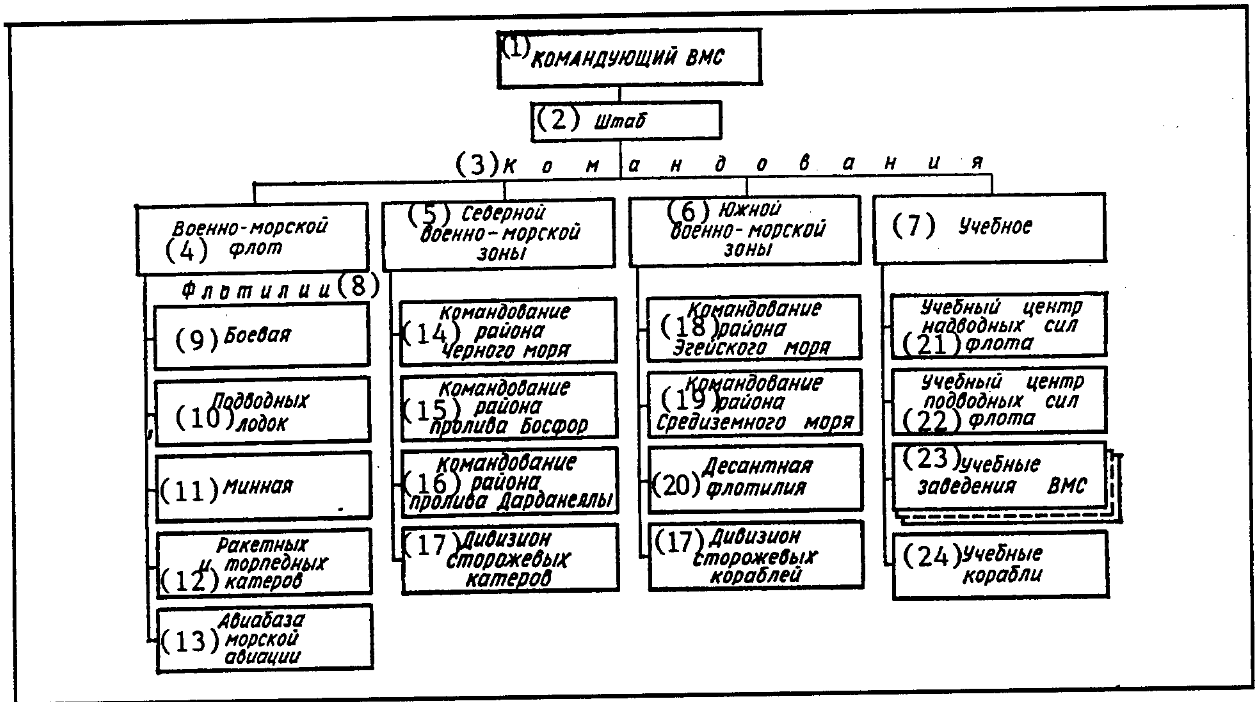


Figure 1. Organization of the Turkish Navy

Key:
1. Naval commander
2. Staff
3. Commands
4. Naval fleet
5. Northern naval zone
6. Southern naval zone
7. Training
8. Flotillas
9. Combat
10. Submarine
11. Minelaying
12. Missile and torpedo boat
13. Naval air base
14. Black Sea regional command
15. Bosporus Strait regional command
16. Dardanelles Strait regional command
17. Patrol boat division
18. Aegean Sea regional command
19. Mediterranean Sea regional command
20. Assault landing flotilla
21. Fleet surface forces training center
22. Fleet submarine forces training center
23. Naval training institutions
24. Training ships

formations and units on the basis of specific classes of ships and branches of forces. It is set up to provide bases to these units and formations, to support their day-to-day activities and combat training, to provide personnel, to provide material support and to conduct repairs. The Turkish navy consists of zones, and a training fleet (Figure 1). When a state of emergency is announced, the coastal defense command, which is subordinated to the minister of internal affairs in peacetime, is transferred wholly or partially to the navy. In wartime and during exercises conducted both within the framework of the national navy and as part of the NATO combined naval forces, operational formations and groups are to be formed.

The naval fleet is the principal major operational formation of the Turkish navy, and it includes practically its entire ship strength. The fleet commander is responsible for combat readiness and for operational and combat training of the formations and units entrusted to him, and he organizes their day-to-day activity. The fleet contains four flotillas (combat, submarine, minelaying, and missile and torpedo boat), and a naval air base. In turn the ship flotillas are divided into divisions.

According to Jane's Ship Strength Handbook the Turkish navy contains around 200 warships and boats, including 17 diesel submarines, 2 guided missile destroyers, 12 destroyers (Figure 2 [not reproduced]), 2 guided missile frigates, 4 frigates, 41 assault landing ships, 33 minesweepers (including 7 minelayers), 14 missile boats, 5 torpedo boats, around 30 patrol boats, over 30 landing craft and 7 inshore minesweepers. The combat characteristics of some ships and boats are given in the table.

Submarines, destroyers and frigates, which are the fighting nucleus of the fleet, are represented chiefly by former

Combat Characteristics of Some Ships and Boats of the Turkish Navy

Type of Ship--Quantity in Operation (Pennant Numbers), Year of Adoption	Displacement, Tons: Standard/ /Total	Principal Dimensions, m: Length Width Draft	Propulsion Unit Output, Horsepower/ /Highest Speed, Knots	Cruising Range, Nautical Miles/ /At a Speed of, Knots	Crew, Persons (Including, Officers)	Armament(1)
			Submarines			
"Atilay" [translitera-tion] (type 209)--6 (S347-352), 1975-1987	980(2)/1,185	56 6.2 5.5	2,400(3)/11 (5,000/22)	7,800(3)/8 (400/4)	33 (.)	533-mm TT--8 (16 torpedoes)
"Canakkale"--2 (S341, 333--ex-USS "Balao"), 1945	1,957/2,450	99.5 8.2 5.2	6,400/17 (5,400/15)	12,000/10(.)	86 (8)	533-mm TT--10 (24 torpedoes or 40 mines)
"Burak Reis"--7 (S335-338,340,345,346--ex-USS "Balao"), 1944-1945	1,848/2,440	93.2 8.2 5.2	4,800/17 (5,400/15)	12,000/10(.)	82 (.)	533-mm TT--10 (24 torpedoes or 40 mines)
"Piri Reis"--2 (S343, 342--ex-USS "Tang"), 1951-1952	2,100/2,700	87.4 8.3 5.8	4,500/16 (5,600/16)	11,000/11(.)	87 (8)	533-mm TT--8 (torpedoes)

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

Destroyers						
"Maresal Fevzi Cakmak"--8 (D345, 348-354--ex-USS "Giring" [transliteration]), 1945-1946	2,425/3,500	119 12.6 5.8	60,000/32	5,800/15 or 2,400/25	275 (15)	Harpoon antiship missile system (on D351, D352), ASROK antisubmarine missile system--1x8 (on D345,348, 350-352), 127-mm AM--2x2m, 40-mm AM--1x2 or 2x2, 35-mm AM--1x2, 324-mm TT--2x3, Hedgehog depth charge launcher--1 (on D349,353, 354)
"Anittepe" [transliteration]--2 (D346, 347--ex-USS "Carpenter"), 1949	2,425/3,540	119 12.6 6.4	60,000/33	5,800/15	275 (15)	ASROK antisubmarine missile system--1x8, 127-mm AM--1x2, 76-mm AM--1x2 (on D347), 35--AM--1x2, 324-mm TT--2x3

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

"Zafer" [transliteration]--1 (D356--ex-USS "Allen M. Sumner"), 1945	2,200/3,320	114.8 12.4 5.8	60,000/32	4,600/15	275 (15)	127-mm AM--3x2, 40-mm AM--2x2, 35-mm AM--1x2, 324-mm TT--2x3, Hedgehog depth charge launchers--2
"Muavenet" [transliteration]--1 (DM357--ex-USS "Robert H. Smith"), 1944	2,250/3,375	114.8 12.4 5.8	60,000/34	4,600/15	274 (.)	127-mm AM--3x2, 40-mm AM--2x4 and 2x2, 324-mm TT--2x3, Hedgehog depth charge launchers--2, mines--80
"Istanbul"--2 (D340, 341--ex-USS "Fletcher"), 1943-1944	2,100/3,050	114.7 12.1 5.5	60,000/32	5,000/15	250 (.)	127-mm AM--4x1, 76-mm AM--3x2, 324-mm TT--2x3, Hedgehog depth charge launchers

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

		Guided Missile Frigates				
"Yavuz" [translitera-tion]--2 (F240,241--type MEK-0200), 1987-1988	2,000/2800	110.5 13.3 4	40,000/27	4,000/20	180 (24)	Harpoon antiship missile system--2x4, Sea Sparrow SAM system--1x8, 127-mm AM--1x1, 25-mm Goalkeeper antiaircraft artillery system--3x4, 324-mm TT--2x3, helicopter
		Frigates				
"Berk" [translitera-tion]--2 (D358, 359), 1972-1975	1,450/1,950	95 11.8 5.5	24,000/25	.	.	76-mm AM--2x2, 324-mm AM--2x3, Hedgehog depth charge launchers--2, depth charge rail
"Gelibolu"--2 (D360, 361--ex-West German "Koln"), 1961-1962	2,100/2,700	110 11 5.1	36,000/28	2,900/22	210 (.)	100-mm AM--2x1, 40-mm AM--2x2 and 2x1, 533-mm TT--4x1, 375-mm Bofors depth charge rocket launcher--2x4, depth charge rails

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

Amphibious Warfare Ships(4)						
"Ertugrul" [transliteration]--2 (L401, 402--ex-USS "Terrebonne Parish"), 1954	2,590/5,800	117 16.8 5.2	6,000/15	15,000/9	116 (.)	76-mm AM--3x2; troop capacity: medium tanks--10, amphibious APCs--17, landing craft--4, marine infantry--395
"Bayraktar" [transliteration]--2 (NL120, 121--ex-USS series 512-1152), 1943	1,653/4,080	100 15.2 4.3	1,700/11	15,000/9	125 (.)	40-mm AM--2x2 and 2x1; troop capacity: marine infantry--125
"Chakabey" [transliteration]--1 (NL122), 1980	1,600/3,600	77.3 12 2.3	4,320/14			40-mm AM--2x2, 20-mm AM--2x2; troop capacity: medium tanks--9, landing craft--2, marine infantry--400(5)

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

"Sarudzhabey" [transliteration]--2 (NL123, 124), 1984-1985	./2,600	92 14 2.3	4,320/14	.	.	40-mm AM--2x2, 20-mm AM--2x2; troop capacity: medium tanks--11, landing craft--2, marine infantry--600(5)
		Coastal Minesweepers				
"Seymen" [translitera-tion]--12 (M507-518--ex-USS "Adjutant"), 1953	320/370	43 8 2.6	1,200/14	2,500/10	38 (4)	20-mm AM--1x2, various types of sweeps
"Trabzon"--4 (M530-533--ex-Canadian "Bay"), 1951-1953	370/470	50 9.2 2.8	2,500/15	4,500/11	35 (4)	40-mm AM--1x1, various types of sweeps
"Karamyursel" [transliteration]--6 (M520-525), 1960	362/378	47.3 8.6 2.9	1,500/15	.	.	20-mm AM--1x2, various types of sweeps
		Inshore Minesweepers				
"Foca"--4 (M500-503--ex-USS "Cape"), 1967	180/235	34 7.1 2.4	960/13	.	30 (.)	12.7--mm machinegun--1x1, various types of sweeps

Combat Characteristics of Some Ships and Boats of the Turkish Navy (cont'd)

			Missile Boats			
"Dogan"--6 (P340-345), 1967-1987	./436	58.1 7.6 2.7	18,000/38	700/35	38 (.)	Harpoon anti-ship missile system--2x4, 76-mm AM--1x1, 35-mm AM--1x2
"Kartal"--8 (P321-324, 326-329), 1967-1968	160/180	42.8 7.1 2.2	12,000/42	650/30	39 (.)	Penguin anti-ship missile system--4x1, 40-mm AM--2x1, 533-mm TT--2x1
			Torpedo Boats			
"Fyrtyna" [transliteration]--5 (P330,331,333, 335,336--former West German "Jaguar"), 1959-1962	160/190	42.5 7.2 2.4	12,000/42	650/30	39 (.)	40-mm AM--2x1, 533-mm TT--4x1

1. The number of missile launchers and artillery mounts, the number of guide rails (containers) and tubes in them, and the number of torpedo tubes are indicated after the multiplication symbol.
2. For submarines, the numerator shows surface displacement, the denominator shows submerged displacement.
3. Power, cruising range and speed are for surface position in the absence of parentheses, and for submerged position in parentheses.
4. Besides those indicated in the table, the Turkish navy has 34 small landing craft with a full displacement of around 600 tons.
5. In the minelayer version it can take up to 150 mines aboard.

American and West German ships acquired at different times through military assistance programs. Ships and boats transferred to the fleet in 1964-1986 are believed to be the most modern. They include "Atilay" class submarines (type 209), "Yavuz" class guided missile frigates (type MEK0200, see color insert [not reproduced]), "Berk" class frigates, "Dogan" class missile boats (Figure 3) equipped with Harpoon antiship missile complexes, and several assault landing ships and patrol boats built in national docks.

Naval aviation consists of 20 Tracker shore-based patrol airplanes (2 S-2A and 18 S-2E) and 9 Agusta Bell ASW helicopters (three AB.204E and six AB.212ASW), which are organized into two squadrons. In the views of the Turkish command, naval aviation will be assigned the following basic wartime missions: hunting and killing enemy submarines independently or in coordination with other branches of the navy; providing antisubmarine defense to warship formations, assault landing detachments and convoys during sea crossings; laying minefields; conducting reconnaissance; conducting search and rescue operations; transporting cargo.

U.S.-produced shore-based patrol airplanes are obsolete. However, some of them have undergone modernization in the USA, during which sufficiently modern submarine detection and tracking apparatus was installed. Antisubmarine helicopters were delivered to Turkey from Italy relatively recently.

The commands of the northern and southern naval zones are territorial operational formations. Their missions are to organize all forms of defense of the coast, naval bases and ports, and materiel support to warship formations in the zones of responsibility of the commands. Under normal conditions they consist only of organs, coastal units, rear units and services, and an insignificant quantity of warships, boats andauxiliary navals. In wartime the needed quantity of warships would be transferred from the feet for combat operations within the bounds of the corresponding zones.

The command of the Northern Navel Zone includes a staff, the commands of the Black Sea, strait of Bosporus and Dardanelles naval regions, and a division of patrol boats.

The command of the Southern Naval Zone consists of a staff, the commands of the Aegean and Mediterranean sea naval regions, an assault landing flotilla and a division of patrol boats.

Coastal artillery units are within the composition of the naval zone commands, and their mission is to fight the enemy's surface ships in the coastal zone. The principal organizational formation is the division [divizion], which contains two or three artillery batteries armed with 152- and 94-mm artillery mounts. The divisions provide air defense with 40- and 20-mm antiaircraft artillery mounts.

Marine infantry, which has a strength of 5,000, is organized into battalions subordinated to the commanders of the naval zones.

The training command contains higher and secondary naval training institutions, training regiments, schools, courses and the training centers of the fleet's submarine and surface forces. Its mission is to solve the problems of training enlisted men, NCOs and officers of the navy.

The coastal defense command coordinates closely with the navy. It is responsible for organizing antiassault-landing and mine defense of the coast, as well as defense of naval bases, basing points and the principal ports of Turkey. The command's peacetime composition includes four zonal coastal defense commands—the Black, Aegean and Mediterranean sea regions, and the Black Sea straight zone. When a state of emergency is announced, the coastal defense command is transferred wholly or partially to the naval command at the decision of the chief of general staff of the Turkish armed forces.

Basing

Turkey possesses a branched system of naval bases and ports which, together with the numerous natural bays and gulfs, provides for dispersed basing of both national and NATO combined naval forces. Its territory contains five naval bases (the main naval base at Golcuk, and the Eregli, Istanbul, Izmir and Iskenderun naval bases), eight basing points and up to 20 major ports. In peacetime, most of the navy's ships are based at the main Golcuk naval base. Reserve ships, repair plants and shops, the supply center, the shipbuilding dock and artillery ammunition, mine and torpedo depots are subordinated in operational respects to the command of the main naval base.

Turkish marine aviation is based predominantly at Topel [transliteration] Air Base.

Personnel Acquisition and Training

The Turkish navy (49,000 persons) is manned on the basis of a law on universal compulsory military service. Eighteen years is the draft age. The term of regular military service is 18 months, after which servicemen are retired into the reserve, where they remain until the age of 46 years. Personnel undergo advanced training while in the reserve. The strength of the trained reserve is around 70,000 persons. New recruits undergo basic military training at naval training centers, after which they are sent to ships and to marine infantry and naval aviation units and subunits. The NCO corps is trained in training centers at Beylerbeyi (in the vicinity of Istanbul) and Golcuk. Officers are trained in the naval school (on the island of Heybeli) and at the academy (in Istanbul).

Prospects for Development

Judging from reports in the foreign press, qualitative improvement of the ship fleet by way of introducing new modern ships and submarines of various classes is the principal direction in the development of the Turkish navy. There are plans for retiring obsolete submarines of the "Canakkale" and "Burak Reis" classes and replacing them with modern type 209 submarines (Figure 4) by the mid-1990s. Six such submarines have already been delivered to the navy, and construction of a total of 12 of them is planned. Construction of type MEK0200 guided missile frigates is continuing (two have been delivered to the fleet and two are nearing completion), as is construction of assault landing ships and missile and patrol boats.

Besides building new ships, the navy is modernizing the ones it has. In particular there are plans for refitting all class "Maresal Fevzi Cakmak" destroyers and "Gelibolu" and "Berk" frigates as guided missile ships. Type SAR33 patrol boats, series production of which has been started at the Tashkyzak building dock in Istanbul, are also to be fitted out with missile weapons.

The command of the Turkish navy attaches rather great significance to increasing the capabilities of naval aviation. The question of replacing Tracker shore-based patrol airplanes in the mid-1990s by American P-3C Orions and of equipping AB.212ASW antisubmarine ships purchased from Italy with English Sea Scua antiship missiles with a range of 22 km is being examined. Following modernization, the helicopters will be able to additionally carry out the following missions: over-the-horizon target indication for ship-to-ship guided missiles, and engagement of the enemy's surface forces independently and in coordination with missile boats.

Operational and Combat Training of the Turkish Navy

The Turkish navy undergoes operational and combat training in accordance with plans of the national command and the NATO combined armed forces, and it is oriented chiefly on missions that must be carried out in wartime. With this purpose the fleet's ships and shore-based units take part in independent and joint armed forces exercises. Judging from reports in the foreign press, the following missions have been carried out in them: switching the navy from a peacetime to a wartime posture in correspondence with the national and NATO alert systems; transferring units and ships to the operational subordination of the bloc's command; forming operational formations and groups and deploying them in their areas of combat use; fighting the enemy's naval forces in the interests of attaining supremacy in the most important regions; providing support to ground troops in maritime sectors; conducting marine assault landing operations and antiassault landing defense of the coastline; maintaining blockades in the strait zone; creating a mine threat and providing antimine support to the activities of friendly forces, and a number of others.

"Display Determination," "Dawn Patrol" and other exercises conducted in the Southern European theater of military operations on the basis of plans of the command of the NATO combined armed forces and the national exercise "Deniz Kurdu" [transliteration] are the biggest combat training measures, in the course of which most of the missions listed above are practiced. Several ships of different classes are usually allocated from the Turkish navy for rehearsal of joint activities within ship formations and specific-purpose groups of NATO's combined naval forces.

English Sea Fox Ship Communication System

18010461i Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 61-62

[Article by Capt 1st Rank N. Starov]

[Text] Forcing growth of the fleet power, the command of the British navy is devoting unweakening attention to improving the control system and one of its important elements—the communication system. In 1983 the Marconi company created the integrated Sea Fox communication system, which supports radio communication and internal telephone communication aboard low displacement ships. It includes the H4640 transceiver, the H1073 power amplifier, the H1473 antenna matching unit, the H6701 control and monitoring instrument, and the H6202 internal telephone communication subsystem.

The H4640 transceiver (Figure 1 [figures not reproduced]) provides single-band telephone (with a complete, weakened or suppressed carrier frequency) and two-band telegraph communication in the 1.5-30 MHz range. It operates in one- or two-frequency simplex mode. Transceivers operating in duplex mode are also produced.

The transceiver is equipped with a microprocessor, the memory of which can store up to 20 working frequency (channel) values both for the transmitter and for the receiver. They are fed into the memory by means of a keyboard on the transceiver's front control panel without disturbing its operation. When ship's power is shut off, internal storage batteries that are constantly charging while the transceiver is working supply power, allowing the memory to store frequency values for 8 days. The transmitter and the receiver are tuned automatically by the microprocessor on the basis of data stored in the memory. The principal components of the transceiver are a receiver, a transmitter, a frequency synthesizer and a power supply unit.

The superheterodyne receiver is capable of dual frequency conversion (its intermediate frequencies are 68.6 and 1.4 MHz). The input circuits are protected from a constant signal of up to 30 V. The receiver may be manufactured with a supplementary frequency range if so desired by the client.

The transmitter (100 mW output power) connects to the H1073 power amplifier.

The frequency synthesizer forms a discrete working frequency spectrum (with a 10 Hz interval between frequencies). In this case either an internal standard frequency source (with relative instability of 1.5×10^{-7} per month) or an external standard frequency source (1.8×10^{-8}) is employed. When both sources are available, preference is given to the latter.

The power supply unit allows the transceiver to operate off a 50 Hz, 115 or 230 V AC circuit.

The overall dimensions of the transceiver are 55x58x61 cm, and it weighs 88 kg. It operates normally at ambient air temperatures from 0 to +55°C.

The H1073 power amplifier (Figure 2) connects to the transmitter and generates output power of up to 400 W, if the H1473 antenna matching unit is used concurrently. The amplifier works within the range of the transceiver, but the lower boundary of the range may be extended to 240 kHz. Output power may be 6, 12, 25, 60, 120, 250 and 400 W.

The amplifier consists of two blocks. One consists of a solid-state wide-band preamplifier and a final stage, while the second consists of a feeding device and a microprocessor which tunes the amplifier itself and the H1473 unit. In addition it monitors current and voltage in the amplifier and the feeding device, and it displays these values on an indicator mounted on the front panel. The microprocessor's memory stores 20 working frequency values. When any of them are selected, the amplifier is tuned within 1.5 seconds. The amplifier can operate in the presence of a sufficiently large value of the standing-wave ratio in relation to voltage, and in the presence of large values of power emitted by transmitters situated next to it aboard the ship.

The overall dimensions of the amplifier are 55x58x61 cm, it weighs 160 kg, and consumed power is 1.5 kW.

The H1473 unit automatically matches the amplifier output to the input resistance of a 7-12 m rod aerial or an equivalent wire aerial operating in the 1.6-30 MHz frequency range. The antenna is tuned in 5 seconds by changing the parameters of a vacuum capacitor and an induction coil controlled by the amplifier's processor. The unit is sealed, and it has an emergency shut-off switch that works when the unit's internal temperature climbs too high. A built-in heater makes it possible for the unit to work normally at low temperatures. The unit's overall dimensions are 75x41x25 cm, and it weighs 37 kg.

The H6701 control and monitoring unit connects party terminals to radio communication equipment and controls and monitors their work remotely. It contains a central control console (Figure 3) and remote panels positioned next to party terminal equipment (teletype, data transceiving apparatus, intercom). The central control panel has a time-division channel multiplex device, which can support 16 party lines connected to it and as many lines for communication with radio equipment with four multiplex buses.

The party communication line is connected to the corresponding lines of the communication equipment (and when necessary they can be quickly disconnected or reconnected to others) by pressing the buttons on the front panel of the central control console. A horizontal row (16 buttons) corresponds to all party lines, while a vertical row (16) corresponds to communication lines. An indicator next to (above) any button turns on when it is pressed, while an indicator opposite two buttons reflects that a connection is made when the two buttons are pressed simultaneously. The console has a safety system that protects against connection of unconnectable communication lines. Communication lines formed in this manner transmit and receive messages, transmit control signals via the transmitter, and receive signals informing on the operating mode of the receiver.

The connection (between a party and radio equipment) and the transmitter emission power are selected and the transceiver is tuned to the working frequency centrally. The output stages of the four transmitters are tuned to six preselected values of emitted power, and their magnitudes are displayed on a digital indicator. The working frequency and operating mode are selected by the operator remotely.

The H6202 internal telephone communication subsystem is intended for conference and group communication, as well as party-to-party communication. A central switchboard capable of connecting up to 16 parties is the main unit of the subsystem (Figure 4). Each party has a control unit equipped with a telephone hand set (or headphones) through which a connection is made to other parties via the central switchboard. There are 16 separate telephone channels for communication between parties. Each of them is furnished with 16 code combinations making it possible to connect automatically to the needed party via the switchboard. The code combination belonging to each party must be composed ahead of time with a keyboard on the front panel of the switchboard and fed into its memory. When the code combination of the required party is dialed and communication with him is established, the necessary information is displayed on the indicator. The central switchboard is connected to the central control console of the H6701 unit, thus allowing parties using radio equipment to communicate in telephonic mode.

The USA's Human Resources and Their Use for Military Purposes

18010461j Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 63-68

[Article by Cand Econ Sci Ye. Anatolyev]

[Text] The United States of America is pursuing a policy of militarism based on the country's economic potential, the largest in the capitalist world. In recent years the military and political leadership of the USA has been devoting increasingly greater attention to supporting the war economy with qualified personnel and to achieving a balanced distribution of available human resources between this sector of the economy and the armed forces. Continual improvement of the qualitative characteristics of people used in these spheres is believed to be one of the ways of increasing military power. This is associated with the fact that American military doctrine presently allows for the possibility of conducting not only fast-moving armed conflicts (of low intensity for example) but also protracted war employing only conventional weapons, in which the state's human resources play an important role.

There are now over 240 million people living in the USA. These sizable human resources are being utilized not only to solve the problems of the state's economic and social development, but also to achieve American imperialism's global military goals. At the present stage of development of scientific and technical progress, both the economy and the armed forces are imposing higher requirements on the general educational and occupational training of persons committed to working in these areas, which aggravates the problem of personnel support to the country's war preparations. Thus reports concerning the Defense Department's personnel difficulties often appear in the American press. The main directions of use of the population in the military sphere are: service in the regular armed forces, personnel acquisition for their reserve components, work as civilian personnel in Defense Department organizations, and Pentagon contracts with the private sector of the economy.

From the standpoint of evaluating the possibilities for utilizing the USA's human resources for military purposes, the American press usually analyzes characteristics such as sex, age, racial and national composition, educational level and the structure of occupations and skills.

The U.S. population represents over 37 percent of that of countries in the NATO bloc. The sex and age structure is characterized by some dominance by women (there are an average of 845 men for every 1,000 women) and a sizable proportion of elderly persons: Over 12 percent of Americans are 65 years and older. There are over 157 million persons of working age (from 16 to 65 years old), which corresponds to approximately 65 percent of the country's total population. Children and adolescents make up 23 percent of the overall number of residents of the USA.

More than 35 million Americans are not representatives of the white race. These are chiefly blacks, the proportion of whom is nearing 12 percent and continuing to grow. The same trend is also typical of other "colored" residents of the country (they are almost 3 percent).

The population of the USA is distinguished by a rather high level of education: Over 19 percent of persons 25 years and older have a higher education. Seventy-two percent of citizens over 16 years old are high school graduates. The educational and skill level of that portion of the population that is employed in the economy and in the armed forces is typically even higher. Thus approximately 20 percent of blue and white collar workers have a higher education. Among blue collar workers, only 15 percent are persons with low skills, while 43 percent are highly skilled specialists. Only 1 out of 10 American recruits does not possess a high school graduation certificate today.

Statistics published by the U.S. Census Bureau show that the number of men aged 18-59 years who could be called up for active military service in the event that a state of emergency is declared in the country attained 67.7 million in 1986. This corresponds to 28 percent of the population and 57 percent of all men. A little more than 3 percent of draft-age men are on active service in the armed forces, while the overwhelming fraction of this category of persons (over 80 percent) are employed in the economy. Since 1983, servicemen serving in units and subunits stationed on U.S. territory (approximately 1.7 million) are categorized by American statistics as persons employed in the economy. However, the bulk of the statistics continue to be published separately in these categories. The distribution of the draft-age U.S. male population in relation to types of activity is shown in Table 1.

As we can see from this table, over three-fourths of men in the USA aged 18-34 years and around nine-tenths aged 35-44 years are presently working in different sectors of the economy. The total number of persons employed in the economy of the United States exceeds 111 million, of whom 56 percent are men. Sectors in which the labor force is dominated by men are construction (91 percent of all employed), mining industry (84 percent), agriculture (79), transportation and communications (73), processing industry (68) and state administration (59). The number of working men in trade is approximately the same as women, while in the services, finances and insurance spheres, the latter dominate.

Table 1. Structure of the Draft-Age Male Population of the USA (1986, Millions of Persons)

Виды деятельности мужчин (1)	(2) Возрастные группы 18—34 года (3)	35—44 года	45—59 лет (3)	Всего в возрасте 18—59 лет (4)	В том числе мужчины белой расы (5)
Занятые в экономике (6)	27,3	14,3	13,6	55,2	48,5
Безработные (7)	2,6	0,8	0,6	4,0	3,0
Учащиеся (с отрывом от производства) (8)	2,0	0,1	0,0	2,1	1,6
Военнослужащие (9)	1,7	0,3	0,0	2,0	1,5
Не занятые экономически активной деятельностью по состоянию здоровья (10)	0,2	0,2	0,5	0,9	0,8
Прочие (11)	1,3	0,6	1,6	3,5	2,7
(12) Всего . . .	35,1	16,3	16,3	67,7	58,1

Key:
1. Men's activity type
2. Age groups
3. Years
4. Total aged 18-59 years
5. Including white men
6. Employed in the economy
7. Unemployed
8. Students (nonworking)
9. Military servicemen
10. Not employed in economically productive activity due to health
11. Others
12. Total

Around one-third of all persons employed in the economy are concentrated in the public services—companies, enterprises, scientific research institutes and institutions providing medical, social, cultural, educational and other public services of this kind. Education and public health each employ approximately 9 million persons alone. A total of 64 percent of the employed population (over 71 million persons) are working in nonproductive sectors of the U.S. economy, while almost half as many (36 percent) work in the sectors of material production, but a higher level of labor productivity is typical of them. For example U.S. agriculture satisfies the country's food demand practically completely, and it also produces a large volume of agricultural products for export, at the same time that only 3.3 million persons are employed in this sector of material production.

Processing industry is the most important sector of the U.S. economy, though not the largest in terms of the number it employs. Today it employs around 21 million persons, of whom over 40 percent are spread among four sectors of the machine building complex (general machine building, electronic and electrical engineering machine building, transportation machine building, instrument making) and metalworking. A rather significant proportion of persons employed in processing industry (around 5 percent) do work directly or indirectly associated with the Defense Department—these are workers in private-sector enterprises filling orders of the military department and employed in state enterprises belonging to the Defense Department (naval building docks, arsenals and munitions plants of the Department of the Army, air force repair plants and so on). According to data in the American press, in 1985 the number of persons involved in military industrial production based on Defense Department contracts was almost 1 million; in this case around 90 percent were in sectors of the machine building complex, 300,000 were in aviation industry, 300,000 were in electronics, 100,000 were in rocket and space industry, and 100,000 were in shipbuilding industry.

As the American press notes, the Defense Department plays an important role in organizing and managing the military sector of processing industry and the country's economy as a whole. Not only administrative institutions but also scientific research laboratories, production enterprises, and various auxiliary enterprises providing services and materiel and personnel support to the armed forces are subordinated to it. In addition to military servicemen, they also employ civilians who are not in the regular armed forces—so-called civilian personnel. In terms of their social and economic status they are categorized as persons employed in the economy, but they carry out functions directly related to supporting activities of the armed forces, and in the opinion of the military and political leadership of the USA, they are an important inherent element of the state's military structure.

In terms of the number of civilians it employs (1.1 million), the U.S. Department of Defense is the country's largest Federal department. The activities of its civilian personnel entail supporting and servicing the

Table 2. Structure of Enlisted Personnel and NCOs in the U.S. Armed Forces (Mid-1980s)

Table 2

Specialties of Servicemen	Percent of Total
Specialists in repair and adjustment of electrical equipment, mechanics	20.0
Office workers	15.7
Persons with combat specialties	14.6
Specialists in intelligence and communications	10.0
Supply and service personnel	9.6
Specialists in repair and adjust--ment of electronic equipment	9.5
Medical personnel	4.8
Others	15.8
Total . . .	100.0

armed forces, developing and producing weapons, military equipment and ammunition, and managing the private sector of the economy in behalf of military programs. The significance of civilian personnel possessing technical specialties and their contribution to the combat readiness of the armed forces are growing as the units and formations are being saturated with complex military equipment requiring constant technical maintenance, repair and so on. Today there is one civil servant for every two servicemen in the regular armed forces. During a mobilization the Defense Department will need to significantly increase the number of civilians it employs in connection with fast growth of military production in the state-run industrial sector and with deployment of the armed forces, which is accompanied by significant growth of the number of personnel employed in materiel support and service.

In 1986 there were almost 2.2 million persons in the regular armed forces of the USA, of whom over 14 percent were officers. Personnel were distributed among the armed services as the following percentages: 36 in the ground troops, 36 in the navy, including the Marine Corps, and 28 in the air force. Almost the same proportions were also typical of civilian personnel (in relation to armed services): 38, 36 and 26 percent respectively.

The country's armed forces are manned on a mercenary basis. Under these conditions the Defense Department devotes considerable attention first to analyzing and evaluating the demographic situation in the country with the purpose of revealing all persons suited to military service in relation to age, physical development, health, mental capabilities and moral qualities, second to sociological research directed at revealing how interested young people are in a military career, and third to studying econometric models[1] making it possible to predict the manpower demand and supply. Because the high level of development of the economy's sectors in the USA corresponds to a no less higher level of equipment availability in the armed forces, men aged 18-24 years with a good general educational background are an object of competition between the Defense Department and private companies. In the present stage, many servicemen have occupations and specialties analogous to those generally encountered in many sectors of the economy. The distribution (structure) of enlisted personnel and NCOs of the U.S. Armed Forces in relation to specialties (in the mid-1980s) is shown in Table 2.

In the time since the draft was repealed in the USA (in 1973), the personnel structure of the country's armed forces has undergone significant changes. While in the

1950s-1960s the proportion of women in the armed forces was insignificant, the officer corps was represented chiefly by white Americans, and unmarried young people dominated the enlisted personnel and NCOs, in the mid-1980s the picture was different.

The USA is presently far ahead of other NATO countries in attracting women to work in the armed forces. Their number is 0.2 million, or over 10 percent of all personnel. The number of female officers has exceeded 30,000. In the air force, 98 percent of the military specialties available to first-term military personnel are open to women, while 86 percent are open to women in the ground troops. The limits are associated with the fact that American laws prohibit women from participating in combat activities. But there are exceptions to the rule: Reports have appeared in the press that women are piloting warplanes. In March 1986 women assumed Minuteman-2 intercontinental ballistic missile service stations at Whitemen Air Force Base, Montana, and consequently they may be among those who are the first to be given the order to initiate a nuclear missile strike. A growing role of women in the U.S. economy is another trend. Thus between 1970 and 1986 the proportion of women in the total employed work force in the economy increased from 38 to 44 percent. Considering these facts, and the experience of the Second World War, the American press concludes that women may make up a certain fraction of the contingent of persons who will be called up into the armed forces in states of emergency.

Since the mid-1980s the personnel of the U.S. Armed Forces (especially the ground troops) have been characterized by presence of a significant percentage of national minorities. Over a quarter of ground troop personnel are blacks. The proportion of Indians, Eskimos and other representatives of the "colored" races in the armed forces (4 percent) is higher than in the economy (2 percent). The naval forces, in which the quantity of representatives of these national minorities attains 6 percent, stand out especially in relation to this indicator. However, a somewhat different pattern is observed among Hispanic Americans (who may be both whites and blacks): Their proportion in the total number of persons employed in the economy is 7 percent, while in the armed forces it is only 4 percent. White and nonwhite servicemen in the USA formally possess equal rights today, but blacks are still concentrated chiefly in the enlisted and NCO ranks, as well as among the three lowest officer ranks. They represent less than 3 percent of the total number of colonels and majors.

Statistics published by U.S. government organs show that in 1985 there were 27.7 million "armed forces veterans" in the country (over 11 percent of the total population), including 26.2 million men and 1.5 million women. "Veterans" include all persons who have been in active military service (both in peacetime and in wartime). Their proportion within the country's total male population that may be called up for military service is 32 percent. The age structure of "veterans," of military servicemen and of persons who had not been in active service is shown in Table 3.

As follows from this table, there are 3.3 million persons among "armed forces veterans" up to 34 years of age, while there are almost twice as many (6.0 million) from 35 to 44 years old. But the overwhelming majority (around two-thirds) of all men who had served in the armed forces are 45 years and older. Some of the "veterans" maintain close ties with the armed forces, since they are in the ready reserves (priority I reserves) and are subject to immediate mobilization in states of emergency. Persons in priority II reserves and in the inactive reserves (priority III) may also be placed in active service in the interests of the Defense Department when necessary. The average age of retirement into the reserves in the USA today is 43 years for officers and 39 years for privates and NCOs. Many former servicemen, including of the higher command level, go to work in military industrial firms, thus strengthening by their personal ties with the Pentagon the position of the military-industrial complex in the country's economic and social life.

In the assessment of American specialists, the years 1981-1985 represented a time of greatest activity in the USA's military preparations in comparison with all preceding years of peaceful life. In the first term of the Reagan administration total outlays for military purposes (purchases of weapons and military equipment, scientific research and experimental design work, military construction and so on) were $780 billion. These assets are ascribed the role of "stimulator" of the country's economic development, and of a weapon against unemployment, in statements of official representatives of the Defense Department. However, research conducted by Employment Research Associated (Lansing, Michigan), a nongovernment consulting company on employment issues, showed that expenditures for military purposes create a smaller number of jobs in the economy than a similar amount of money invested into civilian areas of activity—public health, education, housing construction, industrial sectors producing consumer goods, and so on. The calculations show that in 1981-1985 military expenditures created 72 million jobs (including for servicemen). But this is 1.1 million jobs less than could have been created, had the same money been allocated to development of the economy's civilian sector.

In this same period the six largest Defense Department contractors—Lockheed, Rockwell International, McDonnell Douglas, General Dynamics, Martin Marietta and Grumman—signed military contracts worth over $125 billion. The profit increments of Lockheed and General Dynamics were over 25 percent per year. However, the number of persons employed by enterprises of these firms increased in this period by only 120,000. That is, every billion dollars paid by the Defense Department to these firms provided jobs for

Table 3. Structure of the U.S. Male Population 18 Years and Older in Relation to Armed Forces Membership (1985)

Категории мужчин (1)	(2) Возрастные группы				Итого (5)
	18—24 года (3)	25—34 года	35—44 года	45 лет и старше (4)	
«Ветераны вооруженных сил» (6)	0,4* / 1,5	2,9 / 11,1	6,0 / 22,9	16,9 / 64,5	26,2 / 100,0
Военнослужащие (7)	1,0 / 50,0	0,7 / 35,0	0,3 / 15,0	0,0 / 0,0	2,0 / 100,0
Прочие (8)	13,0 / 23,9	16,8 / 30,9	9,2 / 16,9	15,4 / 28,3	54,4 / 100,0
Всего, млн. человек (9)	14,4	20,4	15,5	32,3	82,6

(10) * В таблице в числителе приведено число мужчин в млн. человек, в знаменателе процент от общей численности данной категории.

Key:
1. Categories of men
2. Age groups
3. Years
4. Years and older
5. Total
6. "Armed Forces Veterans"
7. Military servicemen
8. Others
9. Total, million persons
10. The number of men is shown in the numerator in millions, and the percentage of the total number in this category is given in the denominator

only 960 persons. Considering the fact that in these years General Dynamics bought out several industrial enterprises employing around 20,000, and other firms increased their employment levels partially by the same means, the significance of military contracts as a factor ensuring employment of the population is becoming increasingly less significant.

The Defense Department presently distributes its contracts chiefly among states like California, New York, Texas, Virginia, Maryland, Missouri and Massachusetts, where rocket and space industry, military aircraft building, shipbuilding, nuclear arms production and military electronics are developed. Growth of military purchases in these states results in growth of the number of jobs in industrial sectors in these states oriented on military production. At the same time, reduction of Federal expenditures for civilian purposes is causing a number of production operations to close down. The decrease in the number of jobs in the civil service and in public medical services was especially dramatic in the country in 1981-1985.

The competitiveness of the products of many American firms producing consumer goods has decreased in the world market, which is explained in many ways by reorientation of a significant fraction of Federal expenditures in research and design from civilian to military purposes. In 1986, around 70 percent of all Federal expenditures for research and design were earmarked for research in military areas, while back in 1980 this proportion was 48 percent. Industrial and scientific research firms receiving military orders are concentrating increasingly larger numbers of highly skilled specialists. According to estimates of American specialists 47 percent of all aircraft engineers working in the USA, 43 percent of mathematicians, 25 percent of scientists in the physical and natural sciences, 18 percent of electrical engineers and 11 percent of programmers are being used in support of military objectives. This is detrimental to firms in civilian sectors, which are suffering a drain of a significant fraction of scientists and engineers.

All of these facts refute the myth propagandized by the American administration that military expenditures create additional jobs in the economy, and that use of the population for military purposes ensures growth of employment and reduction of unemployment in the country. Nonproductive deflection of the most productive share of the USA's human resources into the military sphere reflects the militaristic essence of the policy of imperialism and its orientation on confrontation with states of the socialist fraternity.

Footnote

1. Econometrics is a science studying specific quantities, laws and mutual relationships of economic facilities and processes with the assistance of mathematical and statistical methods and models. Models used in econometrics provide numerical results on the basis of statistical, forecasting and planning information.—Editor

Supplying Fuel to the French Armed Forces

18010461k Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 69-73

[Article by Col I. Danilchenko, Cand Tech Sci, and Maj S. Nikitin]

[Text] The conception of an "expanded security zone" forwarded by France in the mid-1970s specifies that regions of "vital interest" to the country extend far beyond the borders of national territory; they include all of Western Europe, including the Mediterranean Sea basin, and some other regions of the globe. This approach foresees maintenance of large armed forces and equipping them with the latest models of weapons and military equipment. As of the beginning of 1988 there were almost 560,000 servicemen in the French armed forces, including the military police. There were over 1,600 tanks, more than 3,000 armored personnel carriers, more than 550 warplanes and 200 cargo airplanes, and around 120 ships. It is emphasized in the foreign press that the armed forces could not fulfill their missions without a meticulously organized system of materiel support, of which fuel supply is an important element.

Satisfaction of the armed forces' demand for this form of materiel was laid upon the fuel supply service, which is subordinated to the armed forces staff and which deals with a wide range of issues. It studies available POL resources, their sources and the demand, it signs contracts with civilian organizations, it accumulates reserves and organizes their storage, it produces some petroleum products at enterprises subordinated to it, it plans, distributes and delivers POL to the armed services, it monitors their quality, and it develops and adopts new grades of POL and fuel supply equipment.

Each year the French armed forces expend over 1 million tons of petroleum, oil and lubricants. The air force is the principal consumer.

As is true with some other Western European states, insufficient availability of local energy resources is typical of France. Energy resources on the country's territory make up about 0.1 percent of world resources, while consumption attains 3 percent, which is why power production depends significantly on imports. Energy programs adopted in 1973-1974 directed at reducing the proportion of oil in the energy balance and increasing the share of atomic energy production made it possible to improve the situation in this area. At the same time, over half of the demand for energy resources is still being satisfied by petroleum, by the products of its refinement and by gas. The country is compelled to import up to 20 percent of the petroleum products it uses (Table 1).

The quantity of operating oil refineries decreased in recent years. There were 16 of them in 1985 (Table 2), and the total oil refining output was around 100 million tons per year. The principal oil refining regions are on the Mediterranean coast near Marseilles, on the country's western shore and between Paris and Le Havre.

The need for importing oil and petroleum products was responsible for the erection of modern deepwater ports for reception of this cargo. Moorings equipped with

Table 1. Production and Import of Some Petroleum Refining Products in the Mid-1980s (Thousands of Tons)

Table 1

Petroleum Products	Production	Import
Aviation gasoline	41	-
Motor vehicle gasoline	15,845	2,577
Aviation kerosene	4,471	46
Kerosene	189	-
Diesel fuel	26,078	6,899
Fuel oil	17,592	4,220
Lubricants	1,460	104

Table 2. Most Important Oil Refineries (1985)

Table 2 Location	Productivity, Millions of Tons Per Year
Gonfreville l'Orcher	16.4
Le-Pti-Kuroi [transliteration]	11.33
Donges	11.18
Feyzin [transliteration]	9.72
Lavera [transliteration]	9.50
Fos	8.55
La-Med [transliteration]	7.10
Mardi [transliteration]	6.37
Gran-Pyui [transliteration]	5.22
Reshstet [transliteration]	4.49
Dunkirque	4.4
Frontignan	4.28
Por-Zherom [transliteration]	3.03
Ambes	2.9

pipelines by which to transfer oil and petroleum products to storage tanks on shore were built in these ports to accommodate high-capacity tankers. Besides permanent off- and onloading systems, use of temporary systems that can be set up quickly is foreseen for the event of a state of emergency.

The country has created a large tanker fleet (as of 1 August 1987 there were 60 tankers with a total cargo capacity of 4.8 million tons in the merchant fleet); in recent years, however, the quantity of ships in operation has been constantly decreasing. Tankers used for oil shipments serve as floating storehouses of oil and petroleum products.

Fuel oil reserves are usually created in the vicinities of offloading ports and the locations of oil refineries (Table 3). Most containers are vertical steel reservoirs on land with a "floating" roof and a capacity of 40,000-160,000 m^3. The largest is the storage area not far from Manosque in the south of France. A former iron ore mine in the vicinity of May-sur-Orne has been adapted for diesel fuel storage.

Table 3. Capacity of the Most Important Oil and Petroleum Product Storage Facilities (Million m^3)

Point (Area) in Which Located	Table 3 Oil	Petroleum Products
Manosque	5	About 9
Le Havre	4.9	0.58
May-sur-Orne	.	5
Fos, Lavera	3.16	0.46
Vincennes (in the Paris vicinity)	.	2.5
le Verdon, Bordeaux	.	1.19*
Dunkirque	1.9	0.44
Donges, Nantes, St. Nazaire	.	1.7

*Oil and petroleum products.

Pipelines are the principal means of delivering oil, its refining products and gas to consumers (including military consumers). Pipelines avoid major population centers, back-up sections are laid at river crossings, and pumping stations are equipped with reserve independent power units.

The military fuel supply system began to be created on French territory before the general national system. French specialists feel that these systems now supplement one another, and actively interact, providing mutual services for the corresponding fees.

Permanent facilities and structures used to supply fuel to the country's armed forces are not an isolated French system. The leadership of the North Atlantic bloc views them chiefly as an inherent part of NATO's infrastructure in Western Europe, inasmuch as they are intended to satisfy the needs of not only national armed forces but also bloc partners. The basis of the system consists of military pipelines used to transport oil refining products (petroleum product pipelines), fuel depots and fuel issue points. These facilities are viewed as an element of the NATO pipeline system in the Central European theater of military operations.

Organizationally the fuel supply service became a unified service for all armed services following World War II. It includes a central administration with units and services subordinated to it (training centers, repair subunits, depots, laboratories and so on), fuel supply service directorates of military, air force and naval districts responsible for supplying petroleum products to units and subunits stationed on their territory, and the representatives of this service attached to various staffs (see diagram). The total number of employees in the fuel supply service is around 3,500, approximately half of whom are civilians.

The bulk of the fuel consumed by troops and naval forces is produced in France's civilian oil refineries. Motor, transmission and other oils are manufactured at a military plant in the city of Lapalisse belonging to the fuel supply service. Petroleum products not produced in the needed quantities in the country are imported.

The fuel supply service receives POL produced in France by way of "fuel supply centers," and POL imported from abroad through "fuel import centers" located in the cities of Lapalisse, Nantes and Poyak [transliteration]. Then the cargo is transported to main and auxiliary fuel depots, from which it is issued to consumers.

Military units and subunits are supplied petroleum products from the nearest fuel supply service depots, or on the basis of contracts from the storage facilities of private companies, and sometimes directly from the oil refineries. The principal grades of petroleum products used are automotive gasoline (NATO designation F-46), diesel fuel (F-54) and fuel for jet engines (F-34, -40 and -42).

Petroleum products are delivered to fuel depots by military as well as civilian transportation (state or private).

The role of pipelines in fuel supply has been rising steadily in recent years. While in 1970 16 percent of the total volume of petroleum refining products were shipped by pipeline transport, in 1987 the distribution was as follows (percent): pipelines—32, motor transportation—31, rail transportation—15, "direct pipelines" (connecting oil refineries directly to depots) and tankers—8.5 each, coastal shipping—5.

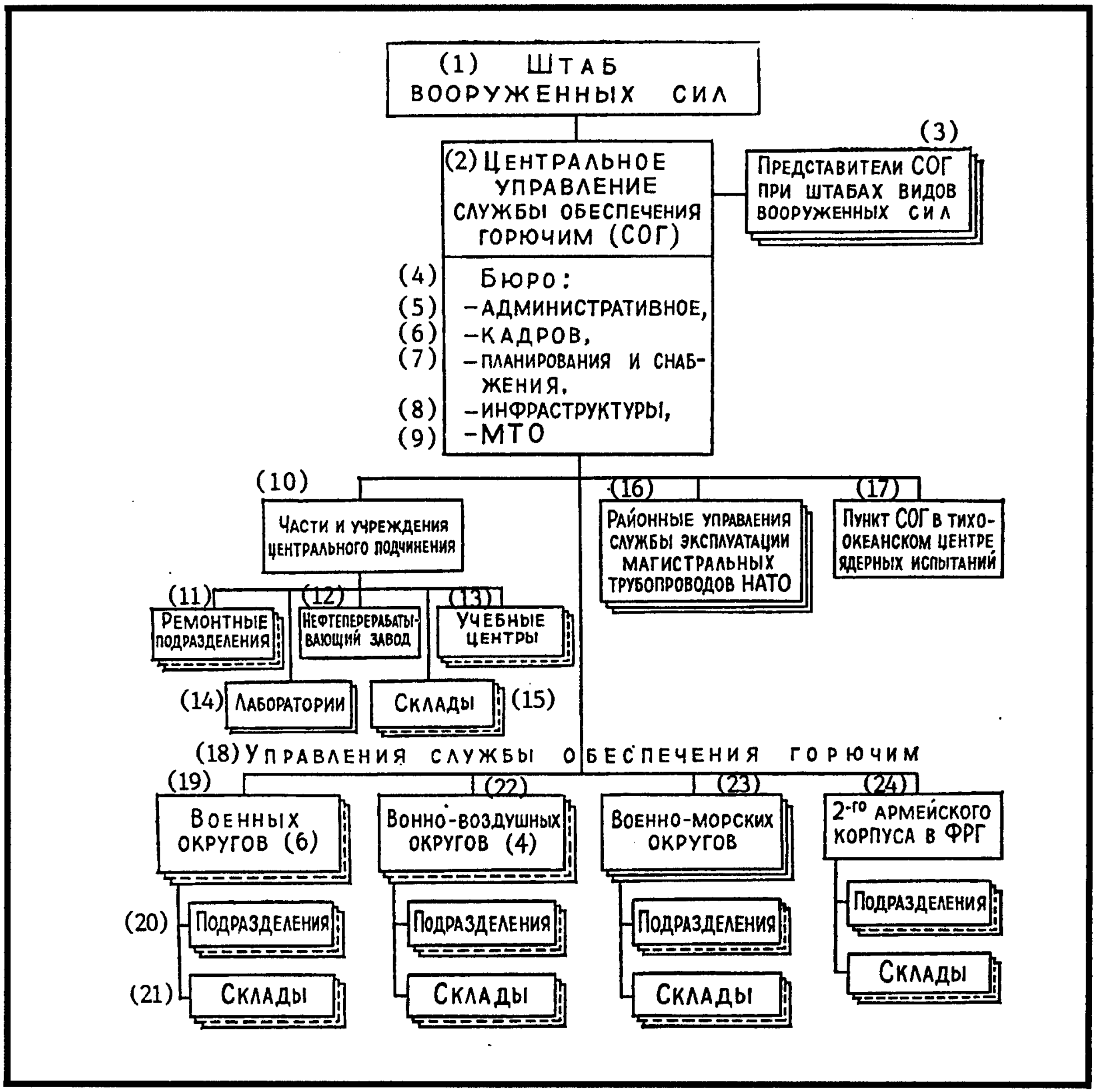
Foreign specialists note that France possesses a sufficiently large fleet of railroad and motor vehicle resources for transporting petroleum products. For example in 1985 civilian organizations had over 4,420 tanker trucks, around 7,460 tanker semitrailers and over 150 tanker trailers with a total capacity of 54,500, 232,000 and 3,200 m^3 respectively. There were 9,370 rail tank cars (with a total capacity of around 660,000 m^3) in civilian organizations and 370 (17,300 m^3) in the fuel supply service for transport of light and dark petroleum products.

The fuel supply service maintains a relatively small fleet of tanker trucks in peacetime—the fleet's total capacity is around 2,600 m^3. But owing to presence of a significant quantity of specialized transportation in the civilian sector, the possibilities for transporting POL in behalf of the armed forces could be increased when necessary.

In order to widen the possibilities for transporting petroleum products by nonspecialized transportation resources, multipurpose containers have been developed. They are used to deliver fuel over relatively short distances by motor, rail and marine general-purpose transportation. A flexible polymer pipeline has been developed for transfer of petroleum products over water obstacles in the absence of bridges and crossing equipment.

The fuel supply system of the ground troops includes fuel supply service units and main and auxiliary depots. In addition this system possesses depots belonging to private companies that sign the appropriate contracts with the defense ministry. There are a total of around 300 fuel supply points (depots) belonging to the fuel supply service in France. The country's territory also has a branched network of private filling stations that could be used in the interests of the armed forces (chiefly by police subunits).

The air force gets its fuel from depots at air force bases or from the nearest private depots having contracts with the fuel supply service. Depots at air bases are serviced by subunits of the fuel supply service that organize airplane refueling. There are 27 air force bases on the country's territory equipped with fuel supply service fuel depots and 20 bases that are supplied by private depots.



Organization of the Fuel Supply Service (regional administrations of the NATO main pipeline operating service also coordinate their work with the Agency for Pipeline Operation in the Central European Theater of Military Operations—a NATO organ)

Key:

1. Armed forces headquarters
2. Central administration of the fuel supply service
3. Fuel supply service representatives at armed forces headquarters
4. Bureaus:
5. Administrative
6. Personnel
7. Planning and supply
8. Infrastructure
9. Materiel support
10. Centrally subordinated units and institutions
11. Repair subunits
12. Oil refinery
13. Training centers
14. Laboratories
15. Depots
16. Regional administrations of the NATO main pipeline operating service
17. Fuel supply service point in the Pacific Ocean nuclear test center
18. Fuel supply service administrations
19. Military districts
20. Subunits
21. Depots
22. Air force districts
23. Naval districts
24. 2d Army Corps in the FRG

The equipment installed at POL depots at air force bases (tanks, pumping stations, pipelines, power production systems) is basically the same as at depots servicing ground troop equipment. The only difference is that additional special filters are installed to remove particles of mechanical impurities larger than 1-2 microns and separating filters that remove free water from fuel, which is dictated by flight safety considerations. Relatively low tank capacity and high fuel turnover are also characteristic of fuel oil depots at air bases. The volume of fuel transferred at these depots is much greater than at those intended for storage of petroleum product reserves. Air base depots have significantly larger quantities of aircraft refueling equipment.

It is noted in the foreign press that the possibilities of refueling equipment possessed by the fuel supply service are 1.7 times greater than those of analogous equipment belonging to civil aviation (given equal storage capacity). Nonetheless in view of the special importance of airplane refueling operations, this service deals constantly with the problems of developing and introducing new technical resources and equipment for this form of support. Its petroleum product storage depots usually accommodate hundreds of thousands of cubic meters of fuel. Most of them are located in ports or in regions in which oil refineries are located, the depots are dispersed, and storage tanks are buried.

The leadership of the fuel supply service devotes significant attention to creating and introducing equipment used directly to supply fuel to troops in a combat situation. In this case the developments of private civilian companies are widely employed in order to save money and hasten introduction of these developments into industrial production.

Flexible containers and storage tanks (Table 4) have been enjoying increasingly greater acceptance in the armed forces in recent years. They are produced chiefly by the French companies Pronal and Kleber [transliterations]. Foreign specialists give a positive evaluation to their qualities, such as low weight and dimensions when packed, and the possibility for using army transportation resources to carry them (for capacities up to 40 m^3). Flexible reservoirs are provided to mobile fuel depots. Located in shelters together with pumping units, they can serve as the basis of a field refueling point. Noting the positive factors of using flexible storage tanks, foreign military specialists concurrently point to some negative aspects. In particular they emphasize their

Table 4. Characteristics of Flexible Storage Tanks Used by the Fuel Supply Service

(1) Показатель	(2) Вместимость, м³					
	1	5	10	80	135	300
Длина, м (3)	1,4	3,4	7,6	8,6	14,0	16,5
Ширина, м (4)	1,4	3,2	2,0	8,2	8,6	14,1
Высота в заполненном состоянии, м (5)	0,55	0,65	1,1	1,3	1,35	1,5
Масса в порожнем состоянии, кг (6)	32	80	120	287	595	878

Key:
1. Indicator
2. Capacity, m^3
3. Length, m
4. Width, m
5. Height when filled, m
6. Weight when empty, kg

Table 5. Characteristics of Fueling Trucks

Characteristics	Brand: TRM4000	TRM6000	GBC8KT
Chassis wheel formula	4x4	4x4	6x6
Tank capacity, liters	5,000	6,000	5,000
Engine	Diesel	Diesel	Multifuel
Maximum speed, km/hr	86	83	80
Filled weight, kg	11,200	12,400	10,780

vulnerability to shell fragments and small-arms fire, difficulty of repair and a relatively low temperature range of normal operation.

Refueling trucks of low capacity as a rule have been created to refuel equipment in the field (Table 5). Because of the unique features of their use in the absence of roads, they are usually modified cross-country vehicles.

On the whole, in the estimation of the French military press, the existing system for supplying the French armed forces with fuel, the fuel reserves that have been accumulated, the organizational structure that has been adopted for the fuel supply service, and presence of skilled personnel and modern troop equipment make it possible to satisfy the demand of the troops for this important form of materiel in both peacetime and wartime.

U.S. Naval Facilities in Subic Bay

18010461l Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 88 (Signed to press 5 Apr 88) pp 73-76

[Article by Capt 2d Rank (Res) V. Maslov]

[Text] Viewing the Asian-Pacific region as an arena of military-political confrontation with the USSR that is second in importance, militaristic circles of the USA have concentrated a major grouping of their armed forces here. The Pentagon maintains a wide network of naval and air force bases and other military facilities on foreign territory to support this grouping's day-to-day and combat activities.

Special attention is attached to military facilities in the Philippines, on which Clark Air Force Base (with an area of 525 km^2) and naval facilities in Subic Bay (146 km^2) are the most important.

The complex of facilities in Subic Bay (Figure 1) is believed to be the largest outside the USA. Its territory contains the Subic Bay Forward Naval Base, the Kubi [transliteration] Point Forward Naval Air Base, a ship repair plant, naval ammunition, POL and supply dumps, a communications center and other facilities (Figure 2 [not reproduced]). The complex underwent continuous construction and expansion, especially during the time of the USA's aggression in Southeast Asia. Thus while in 1968 there were 4,300 U.S. servicemen and civilians and 15,000 Filipinos working there permanently, in 1969 there were over 51,000 naval personnel and families. Today around 7,000 servicemen and over 6,000 members of their families and other U.S. citizens live in and about the complex. The number of Filipinos exceeds 28,000. Around 4,000 former U.S. servicemen and their families have taken up permanent residence in regions adjacent to the complex.

Subic Bay Forward Naval Base (founded in 1904) is located in mountain- ringed Subic Bay on the west coast of Luzon Island, 80 km northwest of Manila, the capital of the Philippines, and 70 km southeast of Clark Air Force Base. The territory of the base occupies around two-thirds of Subic Bay (over 100 km^2). The onshore part of the base occupies over 6,000 hectares, with some of it being covered by jungle. The greatest depth at the entrance to the bay is 40 m, and the water is 30 m deep at anchorages, which provides access to ships of all classes. The base can simultaneously accommodate up to 35 ships of the principal classes, including aircraft carriers.

Coastal and hydraulic engineering structures of the forward naval base underwent constant reconstruction following World War II. The activity increased especially just prior to and during the USA's aggression in Vietnam, when it was the main base of U.S. naval forces taking part in the combat activities. While prior to the beginning of aggression, in 1964, the base was visited by an average of 98 ships and vessels per month, in 1967 the average was 215. In this period up to 25 ships, including two attack carriers, were based here simultaneously. Each day there were about 40 ships and vessels in the bay, and more than 2,600 visits by warships and auxiliary vessels were noted in the course of the year. Presently the base is visited each month by 70-75 American transporters and warships, including aircraft carriers.

The forward naval base includes administrative buildings and moorings (a total of 20, including a mooring wall for aircraft carriers) on the bay's north shore. The total length of line exceeds 5 km. The depth at the moorings attains 14 m.

Key:
1. South China Sea
2. Laoag
3. Luzon
4. Wallace
5. Subic Bay
6. Krou-Velli [transliteration]
7. Capas
8. San Miguel
9. Clark
10. Kubi Point
11. Manila
12. Lubang Island
13. Philippine Sea
14. Paracale
15. Symbols
16. Naval base
17. Air base
18. Headquarters
19. Marine barracks
20. Communications center
21. Transmitting center
22. Receiving center
23. Airplane parking pad
24. Aviation training ground
25. Air defense control center
26. Air defense radar post
27. Ammunition depot
28. Materiel depot
29. POL depot

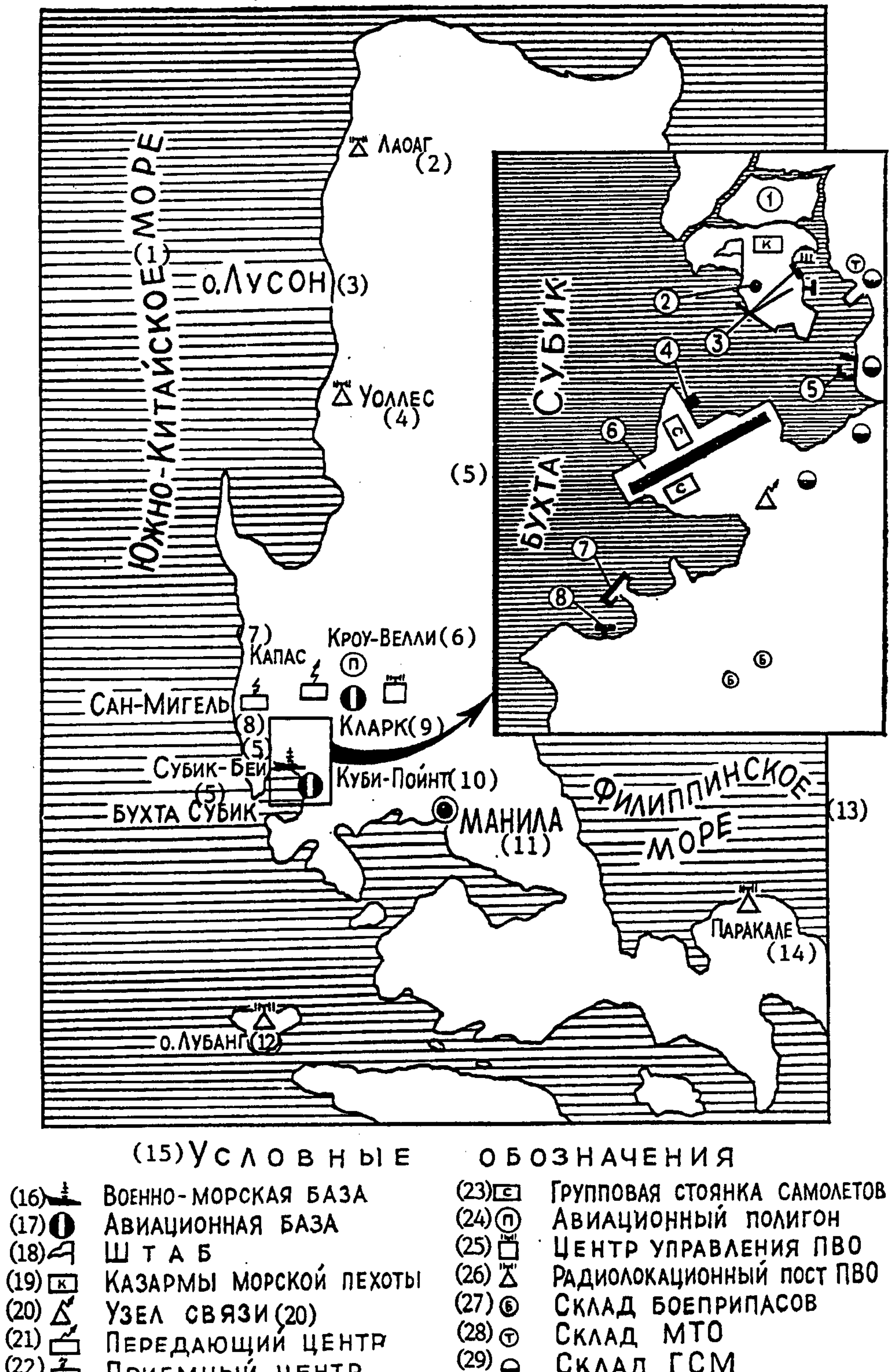


Figure 1. Diagram Showing Locations of Military Facilities: 1—military post; 2—ship repair plant; 3—moorings; 4—special mooring for aircraft carriers; 5—petroleum piers (moorings); 6—Kubi Point Air Base Landing Strip; 7—deepwater concrete mooring for ammunition onloading and offloading; 8—mooring for ammunition onloading and offloading

The headquarters of the U.S. Navy's Philippines command, a naval hospital and a military post are located on base territory.

The Kubi Point Forward Air Base (Figure 3 [not reproduced]) went into operation in 1950. During the period of American aggression in Indochina it was the main center for technical maintenance, repair and supply of about 400 airplanes operating in this region. This air base is one of the largest in the West Pacific; up to 20 airplanes and helicopters are based there permanently, and around 300 craft are there temporarily. The air base has a landing strip 2,740 m long and 60 m wide, three airplane parking pads, 16 hangers, ammunition and POL depots and a communications center. Deck-landing aircraft of carriers undergoing repair are based there periodically, and a separate naval rear support squadron (C-2A Greyhound and UC-12B King Air airplanes) and a separate mixed squadron (DC-130 Hercules and TA-4E Skyhawk airplanes, and Sea Stallion and Sea King helicopters) are stationed there permanently.

The ship repair plant is on the north shore of the bay, and its area exceeds 20 hectares. Five floating building docks and production equipment provide for about 65 percent of the repair needs of the Seventh Fleet, including docking, repair and refitting of ships of all classes. During the time of aggression in Vietnam the plant employed around 250 Americans and 4,500 Filipinos. In that same period, Alawa pier, 183 m long, was built at the shipbuilding dock at a cost of $2.2 million.

Large naval ammunition depots are located south of the air base, and they occupy an area of 4,860 hectares. Rocket, artillery shell, torpedo, mortar shell and bomb storage facilities are accommodated in concrete shelters. Areas for ammunition assembly and checking and torpedo and mortar shell testing stands are there as well. Ammunition is loaded and unloaded from ships anchored at the deepwater Nabazan pier (created at the same time as Alawa pier), to which ships of all classes can moor. In the estimation of Western specialists these ammunition depots are the largest naval depots outside the USA. During the war in Vietnam, floating ammunition depots were also based at Subic Bay Forward Naval Base. They supported the combat activities of the grouping of American troops in South Vietnam against the forces of national liberation.

The petroleum, oil and lubricant depot, which has a capacity of approximately 30,000 m^3, was erected on the eastern shore of Olongapo Bay, where there is a fuel offloading pier. A remote fuel offloading point connected by hoses and underwater pipelines to installations on shore was built (at a cost of $2.3 million) in the vicinity of the depot in 1967. This offloading point makes it possible to unload large tankers. Aviation fuel is also fed from the depot to Clark Air Force Base via a 100-km pipeline. During the period of aggression in Vietnam around 48,000 tons of various fuels passed through the POL depot monthly.

The naval supply depots are next to the ship repair plant. They store materiel and equipment (a total of around 210,000 items valued at over $120 million) necessary for maintenance of ships of all classes and all types of deck-landing and shore-based patrol airplanes and helicopters.

When necessary, naval facilities can be supplied with electric power from a self-contained power plant.

The military post of the complex is designed to accommodate up to 30,000 personnel. Medical services are provided to servicemen and their families by a medical center and a hospital.

Air defense of Subic Bay Forward Naval Base and Kubi Point Air Base is assigned to the combined American-Filipino air defense system, which includes an air defense control center (manned by American and local servicemen), the U.S. Navy's tactical fighter air wing (the airplanes are based at Clark Air Base), and four air defense radar posts serviced by American and Philippine air force subunits.

A naval communications center is located on the territory of the base at Subic Bay. It includes a receiving center in San Miguel (area 10.6 km^2) and a transmitting center in Capas (6.5 km^2). It provides communication with American surface ships and submarines in the South China and Philippine seas. Communication is maintained by a submarine cable with the island of Taiwan and, by way of Guam, with the USA. The naval communications center is part of the Autovon automated telephone communication system and the Autodin digital communication system.

The USA paid the Philippines around $900 million in 1984-1988 for the right to use the territory in which the American bases are located, and $70 million are spent each year on the maintenance of all facilities.

It is noted in the foreign press that naval facilities at Subic Bay are an important link in the chain of forward naval bases in the West Pacific, and the connecting point to bases in the Indian Ocean. Its significance is also determined by the closeness of the Strait of Malacca, and by the possibility allowed for monitoring the situation in the South China and Philippine seas.

In recent years the issue of American bases on the Philippines has become a topic of special concern for the U.S. administration in connection with the impending expiration of the bilateral treaty. Negotiations on this issue should begin this year. American military specialists feel that loss of the base would create a serious breach in the American system of "forward lines" which would be extremely difficult to plug, and that the bases on the Philippines are simply "irreplaceable."

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